Jan 23, 2019

Teresa Homan
[redacted]
Watertown, SD 57201
[redacted]

I am a landowner in Deuel County, South Dakota. Our land boarders the Deuel Harvest Wind Project in Deuel county, Docket # EL18-053. There are 112 towers cited in the project, with 9 towers within a mile of our property.

We have spent over three decades developing this property to enhance wildlife and for the enjoyment of our family. Can you imagine how we felt when we found we have a population of eastern bluebirds? We have yellow warblers, which by the way feed on the web worms that form in our trees. We have orioles, cedar waxwings, brown thrashers, rose breasted grosbeaks, gold finches, purple finches, robins, blue jays, nuthatches, eastern kingbirds, bitterns, dark eyed juncos, red winged blackbirds, morning doves, owls, cow birds, northern mocking birds, grey cat birds, wood thrushes, tufted titmouse, king fishers, indigo buntings, scarlet tanagers, bobolinks, meadowlarks, many woodpeckers, turkeys, turkey vultures, even humming birds and bald eagles. There are more, just to numerous to list. Many of these birds we have seen for the first time in our lives on this property in the past 10 years. Not only are these birds beautiful and fun to watch, they have their purpose in the ecosystem. We also see northern long eared bats, that are on the endangered list in South Dakota.

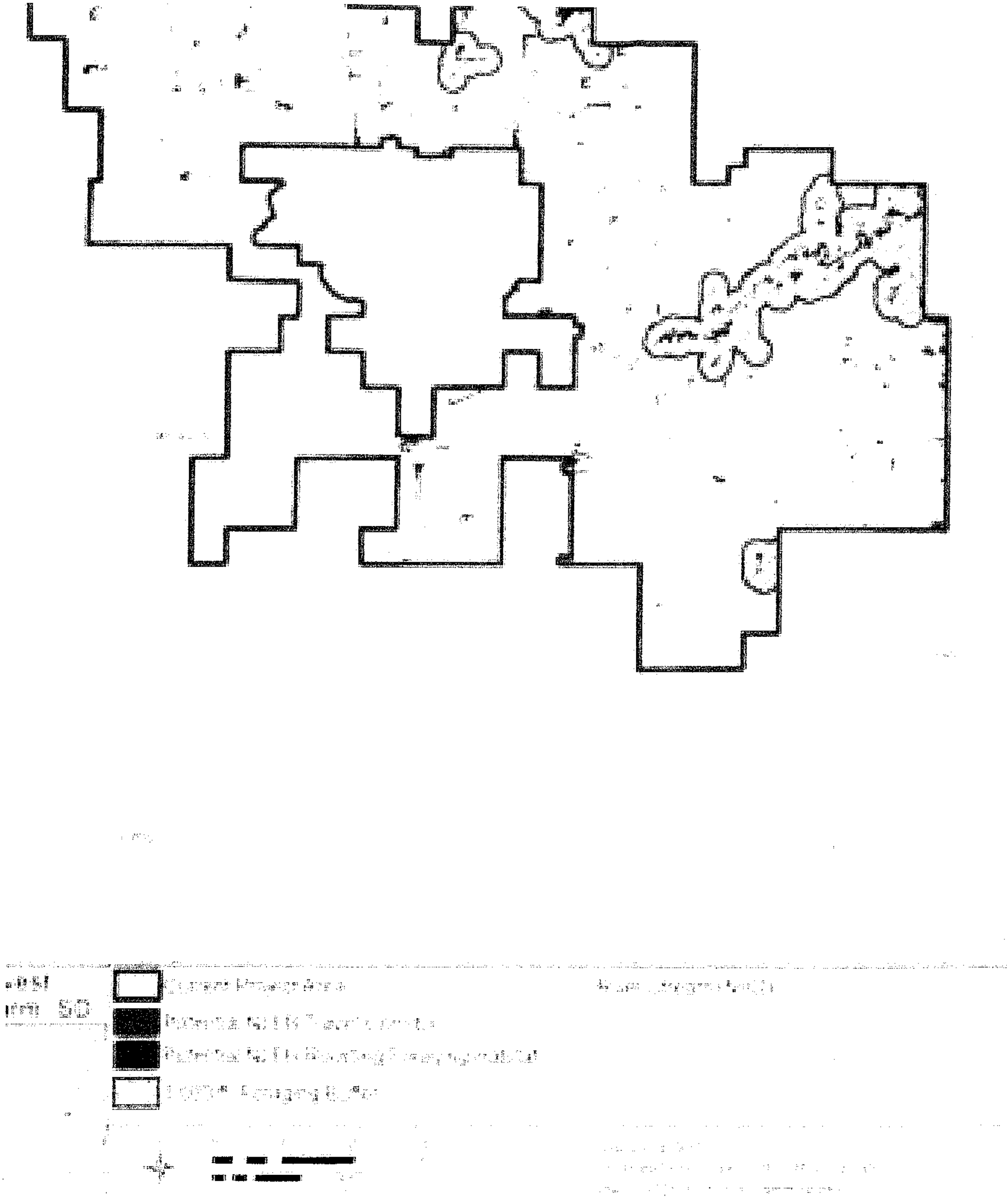
These birds are making a come back after the use of insecticides that nearly wiped out many. In the 1940's the insecticide DDT was introduced for public use, it is now banned from sale. In 1976 the herbicide Roundup was introduced to the public. Both we believed were safe. We did not know then what we know now. There is much negativity out there about wind turbines, should we look the other way when it comes to making safe decisions? So a hand full of people can gain financially? Would you personally like these 600 ft plus wind towers where your family lives or plays? I'm guessing not. If there is a chance that something might be hazardous to your health, wouldn't you stay far away from it? I'm guessing you would.

My husband and I have owned and operated a steel construction company for over 45 years. We could live just about anywhere and still run our business. We chose to live in eastern South Dakota for all it has to offer a growing family. When our kids and grandkids now come home, they can't wait to go for a hike or 4-wheeler ride to see what birds and wildlife they can find. This is a great tool in teaching them about wildlife and the environment.

Shouldn't we in South Dakota err on the side of caution when citing these projects? Keep them a safe distance away from these sensitive wildlife areas and away from people who don't want to be forced to live with them?

Thank you for reading this letter and …Please deny this project.

Teresa Homan



ults of the desktop habitat assessment for northern long-eared bats wil
larvest North Wind Farm in Deuel County, South Dakota.

# Endangered Species

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The Midwest Region includes Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Ohio and Wisconsin. Find a location near you

**Endangered Species Program**

*Conserving and restoring threatened and endangered species and their ecosystems*

Great Lakes RESTORATION

# Northern Long-eared Bat Range Map

This map shows the northern long-eared bat range overlain with forested areas. Because northern long-eared bats require trees for roosting during summer, the forested areas within the range indicate where this bat may occur during times when it is not hibernating (spring through fall).

This map differs from the previous versions in that the range in the United States is depicted by county. We are using counties to identify the range so that it matches the range used to identify the WNS buffer zone used for the northern long-eared bat 4(d) rule.

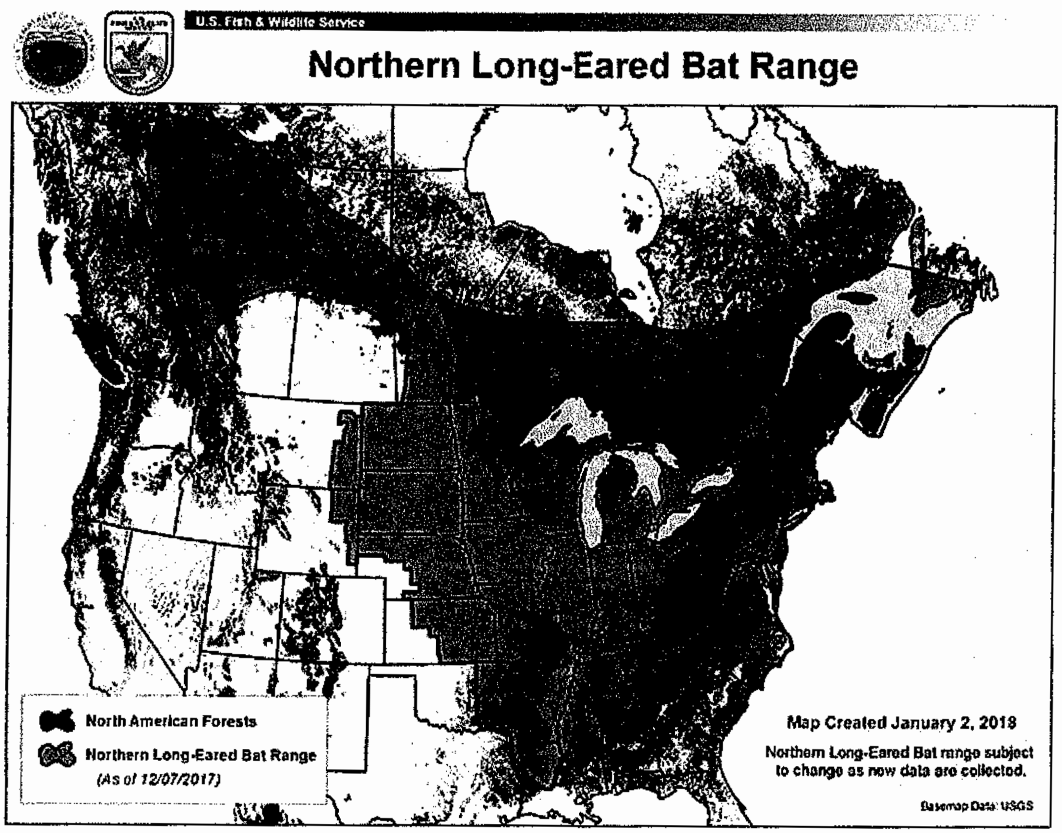


*Image is linked to a pdf version.*

**Counties in Northern Long-eared Bat Range** - updated December 31, 2017 (Excel Spreadsheet)

The U.S. Fish and Wildlife Service is accepting information on known locations of northern long-eared bats and the range could change as this information is provided. For this reason, the depicted range is of the date as identified on the map.

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# Endangered Species

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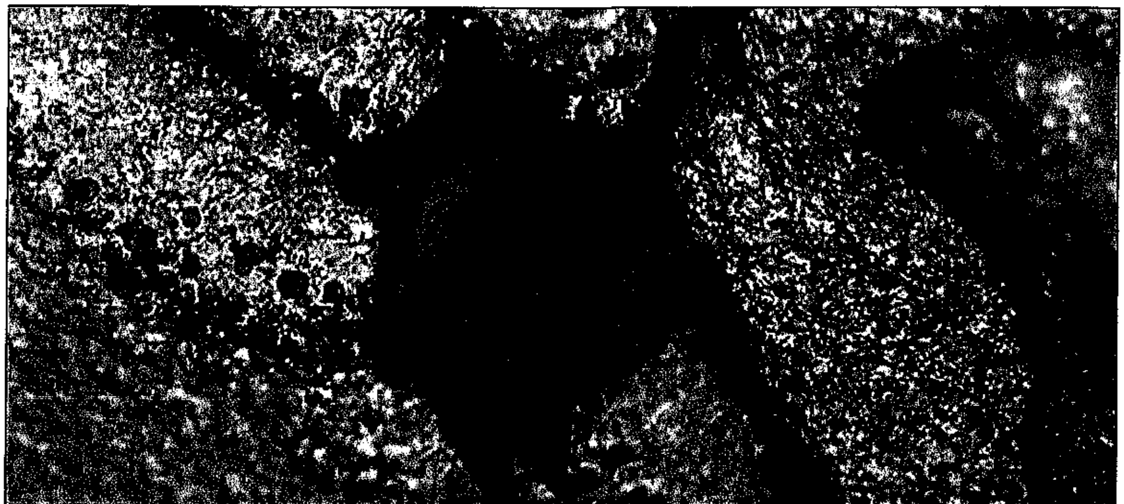

Hibernating northern long-eared bat by Ann Froschauer/USFWS

## Northern Long-Eared Bat (*Myotis septentrionalis*)

**Status:** **Threatened with 4(d) Rule**
**Range:** Alabama, Arkansas, Connecticut, Delaware, the District of Columbia, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, New Hampshire, New Jersey, New York, North Carolina, North Dakota, Ohio, Oklahoma, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Vermont, Virginia, West Virginia, Wisconsin, and Wyoming. Range Map

The northern long-eared bat is one of the species of bats most impacted by the disease white-nose syndrome. Due to declines caused by white-nose syndrome and continued spread of the disease, the northern long-eared bat was listed as threatened under the Endangered Species Act on April 2, 2015. We also developed a final **4(d) rule**, which published in the *Federal Register* on January 14, 2016. The 4(d) rule specifically defines the "take" prohibitions.

## Resources

**4(d) rule**

**Range Map**

**Fact Sheet**

**Wisconsin DNR Fact Sheet**

**Northern Long-eared Bat in Minnesota: A Summary of Relevant Literature**

**Species Profile**

**Archives of Federal Actions**

Northern long-eared bat with symptoms of white-nose syndrome.

*Photo by Steve Taylor; University of Illinois*

**Bats are important to our nation's ecology and economy, eating tons of**

# Federal Project Reviews

## Section 7 Consultation

Section 7 of the Endangered Species Act directs all Federal agencies to work to conserve endangered and threatened species and to use their authorities to further the purposes of the Act. Section 7 of the Act, called "Interagency Cooperation," is the mechanism by which Federal agencies ensure the actions they take, including those they fund or authorize, do not jeopardize the existence of any listed species.

**Section 7 Consultation for Federal Projects that fit under the 4(d) Rule**

**Biological Opinions** - Biological Opinions completed in the Midwest Region

**insects nightly and providing a natural benefit to farmers and foresters. Some research estimates that bats provide at least $3 billion annually in economic value.**

**Habitat:** Hibernates in caves and mines - swarming in surrounding wooded areas in autumn. During late spring and summer roosts and forages in upland forests.

**Lead Region:** 3

**Region 3 Lead Office:** Twin Cities Field Office

**Section 7 Technical Assistance Website** - explains section 7 of the Endangered Species Act and provides step-by-step instructions for the consultation process.

**Programmatic Consultation with Federal Transportation Agencies**

# Find Out More

## Management

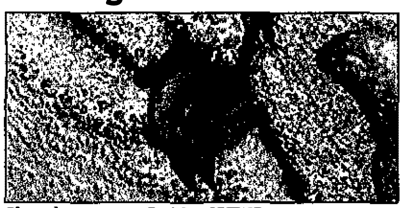

*Photo by Tamara Smith; USFWS*

Helping bats survive white-nose syndrome includes helping them survive overall. The White-Nose Syndrome website porvides information that can help you help bats when carrying out various management activities.

**Management Practices to Help Bats Survive** - links to White-Nose Sydrome Response Team

**Beneficial Forest Managment Practices for Land Managers and Woodland Owners in the Eastern United States**

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## Life History

*Photo by USFWS*

Northern long-eared bats spend winter hibernating in caves and mines, called hibernacula. They use areas in various sized caves or mines with constant temperatures, high humidity, and no air currents. During the summer, northern long-eared bats roost singly or in colonies underneath bark, in cavities or in crevices of both live trees and snags (dead trees).
Fact Sheet
Final Listing Rule (contains a section on Life History)

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## Summer Survey Guidance

*Photo by Pete Pattavina; USFWS*

The Indiana bat Summer Survey Guidance can be used for northern long-eared bat presence/probable absence surveys.

Summer Survey Guidance

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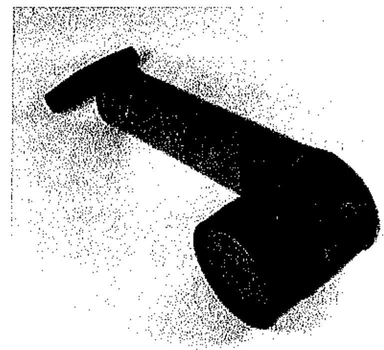
WIKIPEDIA

# Insecticide

**Insecticides** are substances used to kill insects.[1] They include ovicides and larvicides used against insect eggs and larvae, respectively. Insecticides are used in agriculture, medicine, industry and by consumers. Insecticides are claimed to be a major factor behind the increase in the 20th-century's agricultural productivity.[2] Nearly all insecticides have the potential to significantly alter ecosystems; many are toxic to humans and/or animals; some become concentrated as they spread along the food chain.


FLIT manual spray pump for insecticides from 1928

Insecticides can be classified into two major groups: systemic insecticides, which have residual or long term activity; and contact insecticides, which have no residual activity.

Furthermore, one can distinguish three types of insecticide. 1. Natural insecticides, such as nicotine, pyrethrum and neem extracts, made by plants as defenses against insects. 2. Inorganic insecticides, which are metals. 3. Organic insecticides, which are organic chemical compounds, mostly working by contact.


Farmer spraying an insecticide on a cashewnut tree in Tanzania

The mode of action describes how the pesticide kills or inactivates a pest. It provides another way of classifying insecticides. Mode of action is important in understanding whether an insecticide will be toxic to unrelated species, such as fish, birds and mammals.

Insecticides may be repellent or non-repellent. Social insects such as ants cannot detect non-repellents and readily crawl through them. As they return to the nest they take insecticide with them and transfer it to their nestmates. Over time, this eliminates all of the ants including the queen. This is slower than some other methods, but usually completely eradicates the ant colony.[3]

Insecticides are distinct from non-insecticidal repellents, which repel but do not kill.

## Contents

# Type of activity

**Systemic** insecticides become incorporated and distributed systemically throughout the whole plant. When insects feed on the plant, they ingest the insecticide. Systemic insecticides produced by transgenic plants are called plant-incorporated protectants (PIPs). For instance, a gene that codes for a specific *Bacillus thuringiensis* biocidal protein was introduced into corn (maize) and other species. The plant manufactures the protein, which kills the insect when consumed.[4]

**Contact** insecticides are toxic to insects upon direct contact. These can be inorganic insecticides, which are metals and include arsenates, copper and fluorine compounds, which are less commonly used, and the commonly used sulfur. Contact insecticides can be organic insecticides, i.e. organic chemical compounds, synthetically produced, and comprising the largest numbers of pesticides used today. Or they can be natural compounds like pyrethrum, neem oil etc. Contact insecticides usually have no residual activity.

Efficacy can be related to the quality of pesticide application, with small droplets, such as aerosols often improving performance.[5]

# Biological pesticides

Many organic compounds are produced by plants for the purpose of defending the host plant from predation. A trivial case is tree rosin, which is a natural insecticide. Specifically, the production of oleoresin by conifer species is a component of the defense response against insect attack and fungal pathogen infection.[6] Many fragrances, e.g. oil of wintergreen, are in fact antifeedants.

Four extracts of plants are in commercial use: pyrethrum, rotenone, neem oil, and various essential oils[7]

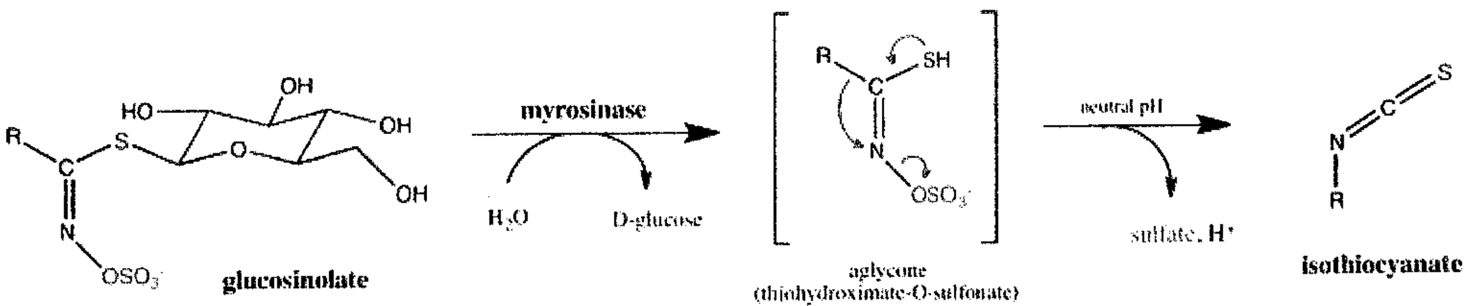
# Other biological approaches

## Plant-incorporated protectants

Transgenic crops that act as insecticides began in 1996 with a genetically modified potato that produced the Cry protein, derived from the bacterium Bacillus thuringiensis, which is toxic to beetle larvae such as the Colorado potato beetle. The technique has been expanded to include the use of RNA interference RNAi that fatally silences crucial insect genes. RNAi likely evolved as a defense against viruses. Midgut cells in many larvae take up the molecules and help spread the signal. The technology can target only insects that have the silenced sequence, as was demonstrated when a particular RNAi affected only one of four fruit fly species. The technique is expected to replace many other insecticides, which are losing effectiveness due to the spread of pesticide resistance.[8]

## Enzymes

Many plants exude substances to repel insects. Premier examples are substances activated by the enzyme myrosinase. This enzyme converts glucosinolates to various compounds that are toxic to herbivorous insects. One product of this enzyme is allyl isothiocyanate, the pungent ingredient in horseradish sauces.




Biosynthesis of antifeedants by the action of myrosinase.

The myrosinase is released only upon crushing the flesh of horseradish. Since allyl isothiocyanate is harmful to the plant as well as the insect, it is stored in the harmless form of the glucosinolate, separate from the myrosinase enzyme.[9]

## Bacterial

*Bacillus thuringiensis* is a bacterial disease that affects Lepidopterans and some other insects. Toxins produced by strains of this bacterium are used as a larvicide against caterpillars, beetles, and mosquitoes. Toxins from *Saccharopolyspora spinosa* are isolated from fermentations and sold as Spinosad. Because these toxins have little effect on other organisms, they are considered more environmentally friendly than synthetic pesticides. The toxin from *B. thuringiensis* (Bt toxin) has been incorporated directly into plants through the use of genetic engineering. Other biological insecticides include products based on entomopathogenic fungi (e.g., *Beauveria bassiana*, *Metarhizium anisopliae*), nematodes (e.g., *Steinernema feltiae*) and viruses (e.g., *Cydia pomonella* granulovirus).

# Synthetic insecticide and natural insecticides

A major emphasis of organic chemistry is the development of chemical tools to enhance agricultural productivity. Insecticides represent a major area of emphasis. Many of the major insecticides are inspired by biological analogues. Many others are completely alien to nature.

### Organochlorides

The best known organochloride, DDT, was created by Swiss scientist Paul Müller. For this discovery, he was awarded the 1948 Nobel Prize for Physiology or Medicine.[10] DDT was introduced in 1944. It functions by opening sodium channels in the insect's nerve cells.[11] The contemporaneous rise of the chemical industry facilitated large-scale production of DDT and related chlorinated hydrocarbons.

### Organophosphates and carbamates

Organophosphates are another large class of contact insecticides. These also target the insect's nervous system. Organophosphates interfere with the enzymes acetylcholinesterase and other cholinesterases, disrupting nerve impulses and killing or disabling the insect. Organophosphate insecticides and chemical warfare nerve agents (such as sarin, tabun, soman, and VX) work in the same way. Organophosphates have a cumulative toxic effect to wildlife, so multiple exposures to the chemicals amplifies the toxicity.[12] In the US, organophosphate use declined with the rise of substitutes.[13]

Carbamate insecticides have similar mechanisms to organophosphates, but have a much shorter duration of action and are somewhat less toxic.

### Pyrethroids

Pyrethroid pesticides mimic the insecticidal activity of the natural compound pyrethrum, the biopesticide found in pyrethrins. These compounds are nonpersistent sodium channel modulators and are less toxic than organophosphates and carbamates. Compounds in this group are often applied against household pests.[14]

### Neonicotinoids

Neonicotinoids are synthetic analogues of the natural insecticide nicotine (with much lower acute mammalian toxicity and greater field persistence). These chemicals are acetylcholine receptor agonists. They are broad-spectrum systemic insecticides, with rapid action (minutes-hours). They are applied as sprays, drenches, seed and soil treatments. Treated insects exhibit leg tremors, rapid wing motion, stylet withdrawal (aphids), disoriented movement, paralysis and death.[15] Imidacloprid may be the most common. It has recently come under scrutiny for allegedly pernicious effects on honeybees[16] and its potential to increase the susceptibility of rice to planthopper attacks.[17]

### Ryanoids

Ryanoids are synthetic analogues with the same mode of action as ryanodine, a naturally occurring insecticide extracted from *Ryania speciosa* (Flacourtiaceae). They bind to calcium channels in cardiac and skeletal muscle, blocking nerve transmission. The first insecticide from this class to be registered was Rynaxypyr, generic name chlorantraniliprole.[18]

## Insect growth regulators

Insect growth regulator (IGR) is a term coined to include insect hormone mimics and an earlier class of chemicals, the benzoylphenyl ureas, which inhibit chitin (exoskeleton) biosynthesis in insects[19] Diflubenzuron is a member of the latter class, used primarily to control caterpillars that are pests. The most successful insecticides in this class are the juvenoids (juvenile hormone analogues). Of these, methoprene is most widely used. It has no observable acute toxicity in rats and is approved by World Health Organization (WHO) for use in drinking water cisterns to combat malaria. Most of its uses are to combat insects where the adult is the pest, including mosquitoes, several fly species, and fleas. Two very similar products, hydroprene and kinoprene, are used for controlling species such as cockroaches and white flies. Methoprene was registered with the EPA in 1975. Virtually no reports of resistance have been filed. A more recent type of IGR is the ecdysone agonist tebufenozide (MIMIC), which is used in forestry and other applications for control of caterpillars, which are far more sensitive to its hormonal effects than other insect orders.

# Environmental harm

## Effects on nontarget species

Some insecticides kill or harm other creatures in addition to those they are intended to kill. For example, birds may be poisoned when they eat food that was recently sprayed with insecticides or when they mistake an insecticide granule on the ground for food and eat it.[12] Sprayed insecticide may drift from the area to which it is applied and into wildlife areas, especially when it is sprayed aerially.[12]

## DDT

The development of DDT was motivated by desire to replace more dangerous or less effective alternatives. DDT was introduced to replace lead and arsenic-based compounds, which were in widespread use in the early 1940s.[20]

DDT was brought to public attention by Rachel Carson's book *Silent Spring*. One side-effect of DDT is to reduce the thickness of shells on the eggs of predatory birds. The shells sometimes become too thin to be viable, reducing bird populations. This occurs with DDT and related compounds due to the process of bioaccumulation, wherein the chemical, due to its stability and fat solubility, accumulates in organisms' fatty tissues. Also, DDT may biomagnify, which causes progressively higher concentrations in the body fat of animals farther up the food chain. The near-worldwide ban on agricultural use of DDT and related chemicals has allowed some of these birds, such as the peregrine falcon, to recover in recent years. A number of organochlorine pesticides have been banned from most uses worldwide. Globally they are controlled via the Stockholm Convention on persistent organic pollutants. These include: aldrin, chlordane, DDT, dieldrin, endrin, heptachlor, mirex and toxaphene.

## Pollinator decline

Insecticides can kill bees and may be a cause of pollinator decline, the loss of bees that pollinate plants, and colony collapse disorder (CCD),[21] in which worker bees from a beehive or Western honey bee colony abruptly disappear. Loss of pollinators means a reduction in crop yields.[21] Sublethal doses of insecticides (i.e. imidacloprid and other neonicotinoids) affect bee foraging behavior.[22] However, research into the causes of CCD was inconclusive as of June 2007.[23]

## Bird decline

Besides the effects of direct consumption of insecticides, populations of insectivorous birds decline due to the collapse of their prey populations. Spraying of especially wheat and corn in Europe is believed to have caused an 80 per cent decline in flying insects, which in turn has reduced local bird populations by a third to two thirds.[24]

# Alternatives

Instead of using chemical insecticides to avoid crop damage caused by insects, there are many alternative options available now that can protect farmers from major economic losses.[25] Some of them are:

1. Breeding crops resistant, or at least less susceptible, to pest attacks.[26]
2. Releasing predators, parasitoids, or pathogens to control pest populations as a form of biological control.[27]
3. Chemical control like releasing pheromones into the field to confuse the insects into not being able to find mates and reproduce.[28]
4. Integrated Pest Management- using multiple techniques in tandem to achieve optimal results.[29]
5. Push-pull technique- intercropping with a "push" crop that repels the pest, and planting a "pull" crop on the boundary that attracts and traps it.[30]

# Examples

### Organochlorides

- Aldrin
- Chlordane
- Chlordecone
- DDT
- Dieldrin
- Endosulfan
- Endrin
- Heptachlor
- Hexachlorobenzene
- Lindane (gamma-hexachlorocyclohexane)
- Methoxychlor
- Mirex
- Pentachlorophenol
- TDE

### Pyrethroids

- Allethrin
- Bifenthrin
- Cyhalothrin, Lambda-cyhalothrin
- Cypermethrin
- Cyfluthrin
- Deltamethrin
- Etofenprox
- Fenvalerate
- Permethrin
- Phenothrin
- Prallethrin
- Resmethrin
- Tetramethrin
- Tralomethrin
- Transfluthrin

### Organophosphates

- Acephate
- Azinphos-methyl
- Bensulide
- Chlorethoxyfos

### Neonicotinoids

- Acetamiprid
- Clothianidin
- Imidacloprid
- Nithiazine

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# Roundup (herbicide)

**Roundup** is the brand name of a systemic, broad-spectrum glyphosate-based herbicide originally produced by the American company Monsanto, which was acquired by Bayer in 2018.[2] Glyphosate is the most widely used herbicide in the United States.[3] As of 2009, sales of Roundup herbicides still represented about 10% of Monsanto's revenue despite competition from Chinese producers of other glyphosate-based herbicides;[4] the overall Roundup line of products (which includes genetically modified seeds) represented about half of Monsanto's yearly revenue.[5]

Monsanto developed and patented the glyphosate molecule in the 1970s, and marketed Roundup from 1973. It retained exclusive rights to glyphosate in the US until its US patent expired in September, 2000; in other countries the patent expired earlier. The Roundup trademark is registered with the US Patent Office and still extant. However, glyphosate is no longer under patent, so similar products use it as an active ingredient.[6] As of January 2019, "the sale, distribution, and use of Roundup 360 is banned" in France.[7]

The main active ingredient of Roundup is the isopropylamine salt of glyphosate. Another ingredient of Roundup is the surfactant POEA (polyethoxylated tallow amine).

Monsanto also produced seeds which grow into plants genetically engineered to be tolerant to glyphosate, which are known as *Roundup Ready* crops. The genes contained in these seeds are patented. Such crops allow farmers to use glyphosate as a post-emergence herbicide against most broadleaf and cereal weeds.

**Roundup**

| | |
|---|---|
| **Manufacturing status** | |
| **Manufacturer** | Bayer |
| **Type** | Herbicide |
| **Introduced to market** | 1976[1] |
| **Purposes** | |
| **Agriculture** | non-selective post-emergence weed control |
| **Herbicide properties** | |
| **Surfactant** | Polyethoxylated tallow amine (most common) |
| **Main active ingredient** | Isopropylamine salt of glyphosate |
| **Mode of action** | 5-enolpyruvylshikimate-3-phosphate synthase(EPSPS) inhibitor |

## Contents

# Composition

Beyond the glyphosate salts content, commercial formulations of Roundup contain surfactants, which vary in nature and concentration. As a result, the effects of this herbicide are not with the main active ingredient alone, but with complex and variable mixtures.[8]

# Acute toxicity

Roundup contains the surfactant polyethoxylated tallow amine (POEA), which makes it more toxic for aquatic species than some other glyphosate formulations.[9][10] Independent scientific reviews and regulatory agencies have regularly concluded that glyphosate-based herbicides do not lead to a significant risk for human or environmental health when the product label is properly followed.[11]

## Human

The acute oral toxicity for mammals is low,[9] but death has been reported after deliberate overdose of concentrated Roundup.[12] The surfactants in glyphosate formulations can increase the relative acute toxicity of the formulation.[13] Surfactants generally do not, however, cause synergistic effects (as opposed to additive effects) that increase the acute toxicity of glyphosate within a formulation.[13] The surfactant POEA is not considered an acute toxicity hazard, and has an oral toxicity similar to vitamin A and less toxic than asprin.[14] Deliberate ingestion of Roundup ranging from 85 to 200 ml (of 41% solution) has resulted in death within hours of ingestion, although it has also been ingested in quantities as large as 500 ml with only mild or moderate symptoms.[15] Consumption of over 85 ml of concentrated product is likely to cause serious symptoms in adults, including burns due to corrosive effects as well as kidney and liver damage. More severe cases lead to "respiratory distress, impaired consciousness, pulmonary edema, infiltration on chest X-ray, shock, arrhythmias, renal failure requiring haemodialysis, metabolic acidosis, and hyperkalaemia" and death is often preceded by bradycardia and ventricular arrhythmias.[13]

Skin exposure can cause irritation, and photocontact dermatitis has been occasionally reported. Severe skin burns are very rare.[13] In a 2017 risk assessment, the European Chemicals Agency (ECHA) wrote: "There is very limited information on skin irritation in humans. Where skin irritation has been reported, it is unclear whether it is related to glyphosate or co-formulants in glyphosate-containing herbicide formulations." The ECHA concluded that available human data was insufficient to support classification for skin corrosion or irritation.[16]

Inhalation is a minor route of exposure, but spray mist may cause oral or nasal discomfort, an unpleasant taste in the mouth, or tingling and irritation in the throat. Eye exposure may lead to mild conjunctivitis. Superficial corneal injury is possible if irrigation is delayed or inadequate.[13]

### Aquatic

Glyphosate formulations with POEA, such as Roundup, are not approved for aquatic use due to aquatic organism toxicity.[17] Due to the presence of POEA, glyphosate formulations only allowed for terrestrial use are more toxic for amphibians and fish than glyphosate alone.[17][18][19] Terrestrial glyphosate formulations that include the surfactants POEA and MON 0818 (75% POEA) may have negative impacts on various aquatic organisms like protozoa, mussels, crustaceans, frogs and fish.[9] Aquatic organism exposure risk to terrestrial formulations with POEA is limited to drift or temporary water pockets.[17] While laboratory studies can show effects of glyphosate formulations on aquatic organisms, similar observations rarely occur in the field when instructions on the herbicide label are followed.[11]

Studies in a variety of amphibians have shown the toxicity of products containing POEA to amphibian larvae. These effects include interference with gill morphology and mortality from either the loss of osmotic stability or asphyxiation. At sub-lethal concentrations, exposure to POEA or glyphosate/POEA formulations have been associated with delayed development, accelerated development, reduced size at metamorphosis, developmental malformations of the tail, mouth, eye and head, histological indications of intersex and symptoms of oxidative stress.[19] Glyphosate-based formulations can cause oxidative stress in bullfrog tadpoles.[20] The use of glyphosate-based pesticides are not considered the major cause of amphibian decline, the bulk of which occurred prior to widespread use of glyphosate or in pristine tropical areas with minimal glyphosate exposure.[21]

A 2000 review of the toxicological data on Roundup concluded that "for terrestrial uses of Roundup minimal acute and chronic risk was predicted for potentially exposed nontarget organisms". It also concluded that there were some risks to aquatic organisms exposed to Roundup in shallow water.[22]

## Carcinogenicity

There is limited evidence that human cancer risk might increase as a result of occupational exposure to large amounts of glyphosate, such as agricultural work, but no good evidence of such a risk from home use, such as in domestic gardening.[23] The consensus among national pesticide regulatory agencies and scientific organizations is that labeled uses of glyphosate have demonstrated no evidence of human carcinogenicity.[24][25] Organizations such as the World Health Organization (WHO) and the Food and Agriculture Organization, European Commission, Canadian Pest Management Regulatory Agency, and the German Federal Institute for Risk Assessment[26] have concluded that there is no evidence that glyphosate poses a carcinogenic or genotoxic risk to humans.[24] The final assessment of the Australian Pesticides and Veterinary Medicines Authority in 2017 was that "glyphosate does not pose a carcinogenic risk to humans".[24][27] The EPA has classified glyphosate as Group E, meaning "evidence of non-carcinogenicity in humans".[24][28] Only one international scientific organization, the International Agency for Research on Cancer (IARC), affiliated with the WHO, has made claims of carcinogenicity in research reviews. The IARC has been criticized for its assessment methodology by failing to consider the broad literature and only assessing hazard rather than risk.[24]

# Legal

On 10 August 2018, Dewayne Johnson, who has non-Hodgkin's lymphoma, was awarded $289 million in damages after a jury in San Francisco found that Monsanto had failed to adequately warn consumers of cancer risks posed by the herbicide,[29] a decision the company plans on appealing.[30] Johnson had routinely used two different glyphosate formulations in his work as a groundskeeper, RoundUp and another Monsanto product called Ranger Pro.[31][32] The jury's verdict addressed the question of whether Monsanto knowingly failed to warn consumers that RoundUp could be harmful, but not whether RoundUp causes cancer.[33] Court documents from the case show the company's efforts to influence scientific research via ghostwriting.[34] After the IARC classified glyphosate as "probably carcinogenic" in 2015, over 300 federal lawsuits have been filed that were consolidated into a multidistrict litigation called *In re: RoundUp Products Liability*.[35]

## False advertising

In 1996, Monsanto was accused of false and misleading advertising of glyphosate products, prompting a law suit by the New York State attorney general.[36] Monsanto had made claims that its spray-on glyphosate based herbicides, including Roundup, were safer than table salt and "practically non-toxic" to mammals, birds, and fish, "environmentally friendly", and "biodegradable".[37][38] Citing avoidance of costly litigation, Monsanto settled the case, admitting no wrongdoing, and agreeing to remove the offending advertising claims in New York State.[38]

Environmental and consumer rights campaigners brought a case in France in 2001 accusing Monsanto of presenting Roundup as "biodegradable" and claiming that it "left the soil clean" after use; glyphosate, Roundup's main ingredient, was classed by the European Union as "dangerous for the environment" and "toxic for aquatic organisms". In January 2007, Monsanto was convicted of false advertising and fined 15,000 euros. The result was confirmed in 2009.[39][40]

## Falsification of test results

Some tests originally conducted on glyphosate by contractors were later found to be have been fraudulent, along with tests conducted on other pesticides. Concerns were raised about toxicology tests conducted by Industrial Bio-Test Laboratories in the 1970s[41] and Craven Laboratories was found to have fraudulently analysed samples for residues of glyphosate in 1991.[42] Monsanto has stated that the studies have since been repeated.[43]

## Ban in France

In January 2019, Roundup 360 was banned in France following a court ruling that regulator ANSES had not given due weight to safety concerns when they approved the product in March 2017. The ban went into effect immediately.[44][7]