UTAH PLANT HEALTH

Extension
UtahStateUniversity.

Utah IPM Program and Utah Plant Pest Diagnostic Laboratory

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IN THIS ISSUE

NEW MEDIA

[Transition to Organic: Alfalfa Production]

Keeping an Eye Out for Oak Gall Wasps

Oak galls are abnormal growths or deformations usually present on the leaves of oak trees. Among the insects that cause galls are tiny, non-stinging wasps in the widespread family Cynipidae.

These wasps, particularly species in the genus *Neuroterus*, have a fascinating and often complex life cycle. Females lay eggs in young, actively growing oak tissues, and the developing larvae release hormones that redirect the tree's growth, forming the protective involucrum known as a gall. Inside this structure, the larva feeds, molts, and eventually pupates. Many species have two generations per year, often with very different gall types, one on leaves and another on buds or twigs. Adult wasps are tiny, short-lived, and emerge just as new oak growth appears, perfectly timed to start the cycle again. Most species overwinter inside fallen leaf galls or within dormant bud galls, emerging the following spring. The shape and color of the gall varies depending on the wasp species and developmental stage. Depending on the timing, a microscope view of an open gall reveals the presence of one developing wasp larva or a fully formed adult inside a spongy-looking case.

In Utah and the Intermountain West, especially in areas dominated by gambel oak (*Quercus gambelii*), gall-making insects are common, but published evidence of *Neuroterus* species in the state is limited. Suitable host trees and the widespread distribution of related gall wasps across the West indicate that they may be more

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common than we think. In fact, the Utah Plant Pest Diagnostic Lab (UPPDL) received many inquiries and a few samples in fall 2025 that were confirmed as *Neuroterus* wasps.

Most *Neuroterus* oak galls are harmless and require no treatment. The damage is often purely cosmetic and rarely causes long-term harm to established oak trees. Therefore, management of these gall wasps should focus on plant health, appropriate sanitation, and the conservation of natural enemies. Recommendations include keeping trees healthy with deep watering during drought, mulching, and avoiding unnecessary pruning or trunk/root injury. In addition, rake and discard fallen, gall-infested leaves to help reduce their populations. Heavy gall years usually subside naturally as weather patterns and beneficial insects naturally regulate populations. Since larvae are protected inside the galls and some life-cycles are complex, insecticides are not recommended and sprays offer little benefit.

Despite the potential cosmetic nuisance these galls may cause, the risk to tree health is minimal. Their potential ecological and under-studied importance makes them an interesting subject for investigation.

— Ernane Vieira-Neto, Arthropod Diagnostician and Claudia Nischwitz, Extension Plant Pathologist

Top and bottom: Cynipid oak gall samples received by the UPPDL in late summer and fall 2025 caused by *Neruoterus* species.

Middle: Microscopy images of intact round-type gall and cut round-type gall, exposing the fully-formed adult.

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Lessons from Invasive Insect Surveys: Caring for Our Bees

Tori Strausser, Master's student, and Dr. Fabiane Mundim, Assistant Professor of Insect Ecology, Department of Biology, USU

The Mundim lab studies the ecology of plant interactions with herbivores and parasites, particularly below-ground herbivores that affect above-ground ones.

Queen and worker *Bombus* bees as examples of bycatch from invasive species trapping surveys.

The USDA Animal and Plant Health Inspection Service (APHIS) conducts nationwide surveys through the Plant Protection and Quarantine (PPQ) program to detect invasive insect pests before they can spread and cause economic or ecological damage. These early detection and rapid response programs protect agricultural production, natural resources, and local ecosystems. Utah State University has conducted field and specialty crop surveys throughout Utah for decades, and numerous farmers in the state provide access to fields that are essential for monitoring pest populations. Most recently, USU researchers are implementing the invasive detection program in orchard crops and Solanaceous vegetables (potatoes, tomatoes, and eggplants).

Survey Methods: Buckets and Timing

USDA surveys use a variety of traps, each tailored to a particular invasive pest. One common method is the bucket trap, which attracts insects using a lure and collects them in a container for identification. Traps are placed within crop fields at the beginning of the season and are checked twice a month. Survey timing varies depending on the crop and target species. Field crop surveys typically begin in May, Solanaceous crop surveys may begin in June, and orchard surveys start in July. Proper timing has been shown to be critical not only for effective detection of invasive pests but also for reducing impacts on non-target organisms.

What is Bycatch?

Although traps are designed to attract specific invasive pests, they also capture non-target species, known as bycatch. In these surveys, bycatch often includes bees and other beneficial insects. While bycatch is not the primary focus of APHIS surveys, studying these species provides valuable insight into local pollinator and beneficial insect populations, which are essential for ecosystem health and agricultural productivity. Bycatch from our traps is not discarded but set aside, as it can offer a unique opportunity to study pollinator populations.

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Using Bycatch to Study Bee Populations

In a collaborative project between the USDA Bee Lab (Logan, UT), the USU survey team, and as part of a master's research project, we analyzed *Bombus* (bumble bee) bycatch saved from field crop (corn and alfalfa) surveys conducted from 2014-2019. In those surveys, timing of trap deployment was early season (April–May) in some years and later (June) in more recent years. We measured each bee's size, determined its reproductive stage (queen or worker), and analyzed its genetics. The data we collected helps us to understand whether survey traps had any negative effects on local bee populations and on farms dependent on these pollinators.

Bee Size and Population Trends

We found that *Bombus* populations in northern Utah are generally decreasing in size over time. However, trap placement timing is important. Traps deployed very early in the season (April–May) are more likely to capture potential queens that have not yet established colonies. Later deployments of traps (June) primarily capture worker bees and do not harm newly-established or future colonies. Therefore, when surveys are conducted at the appropriate time, invasive species monitoring does not negatively affect local bee populations. These findings provide reassurance to researchers, land managers, and farmers that invasive insect surveys can be conducted responsibly without compromising pollinator health.

Broader Implications for Pollinator Conservation

Repurposing bycatch data, which would otherwise be discarded, has broader implications for insect monitoring in general. Studying non-target species like bees allows survey programs to identify potential risks to pollinators and develop strategies to minimize them. For instance, adjusting trap deployment timing is a simple yet effective way to reduce impacts on new queens and young bee colonies.

Bucket trap used for invasive moth detection program, and example of catches, including *Bombus* bycatch.

Although our study is specific to northern Utah, these lessons can inform invasive species monitoring in other regions, helping balance pest surveillance needs with pollinator conservation. Additionally, analyzing historical bycatch data can track changes in bee populations over time, examine regional trends, and explore factors influencing pollinator health.

Looking Ahead

USU continues to collaborate with USDA-APHIS-PPQ on both orchard and Solanaceous crop surveys, ensuring that monitoring for invasive pests remains both effective and environmentally responsible. These efforts reflect a growing recognition that protecting pollinators and managing pests are complementary goals, not conflicting ones. Invasive insect surveys are essential for protecting crops and natural ecosystems, but they also present an opportunity to study non-target species like bees.

Resources and Further Reading

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Mosquitoes and West Nile Virus

Norah Saarman's lab is part of the Ecology Center and the Department of Biology at Utah State University. She studies the genetics and ecology of species that most of ignore or avoid — mosquitoes, tsetse flies, beetles, bees, and other "creepy crawlies." These insects play outsized roles in ecosystems and human health, from pollination to spreading disease.

Most people think of mosquitoes as a single amorphous annoyance waiting to bite ankles at any opportunity, but there are actually over 3,000 mosquito species worldwide—and some of them are so focused on the taste of bird blood that they wouldn't touch your ankle even if it were the only blood available for miles around. In Utah, mosquitoes that like the taste of both bird and mammal blood, such as the southern house mosquito (*Culex quinquefasciatus*), are especially dangerous because they can spread West Nile virus (WNV) from amplifying hosts like the house finch and American robin to "dead-end" hosts such as horses, dogs, and humans.

West Nile virus has been a threat to American public health since it was introduced in New York in 1999,

Southern house mosquito taking a blood meal from a human arm.
Image courtesy CDC Public Health Image Library #17697, James Gathany

Symptoms of West Nile Virus

- 80% of people have no symptoms.
- 20% may have fever, headache, body aches, fatigue, joint pains, vomiting, diarrhea, or rash, and may recover within weeks.
- Less than 1% develop severe illness that requires hospitalization.

quickly spreading across the United States and arriving in Utah by 2003. Since then, WNV activity has fluctuated from year to year, rising and falling with bird populations, mosquito abundance, and seasonal weather patterns. Wet years and overwatering provide ideal breeding sites—stagnant water in wetlands, storm drains, irrigation leaks, and backyard containers—all of which allow mosquito populations to boom. You can explore this roller coaster ride of disease transmission on the CDC's website.

2025 was an especially bad year for WNV in Utah, particularly in northern counties like Cache County, which saw 18 confirmed human cases. Given that only about 1 in 112 infections are typically detected through case counts, that implies thousands of actual infections—most of them mild or asymptomatic and therefore undiagnosed.

While the yearly swings in WNV activity remain somewhat mysterious, one thing is clear: WNV is amplified in birds. In Utah, we believe this is primarily happening in house finch populations. In the Saarman Lab at Utah State University—through both research and student participation in core biology courses—

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we've been sequencing DNA from mosquito blood meals collected in Salt Lake City. We've found that the vast majority of mosquito feeding in common urban areas is on birds, primarily house finches and robins. Only about 1% of blood meals came from mammals. This suggests that virus amplification is happening in our backyards and neighborhoods, where water can be found in storm drains and bird baths, and house finches and robins are abundant.

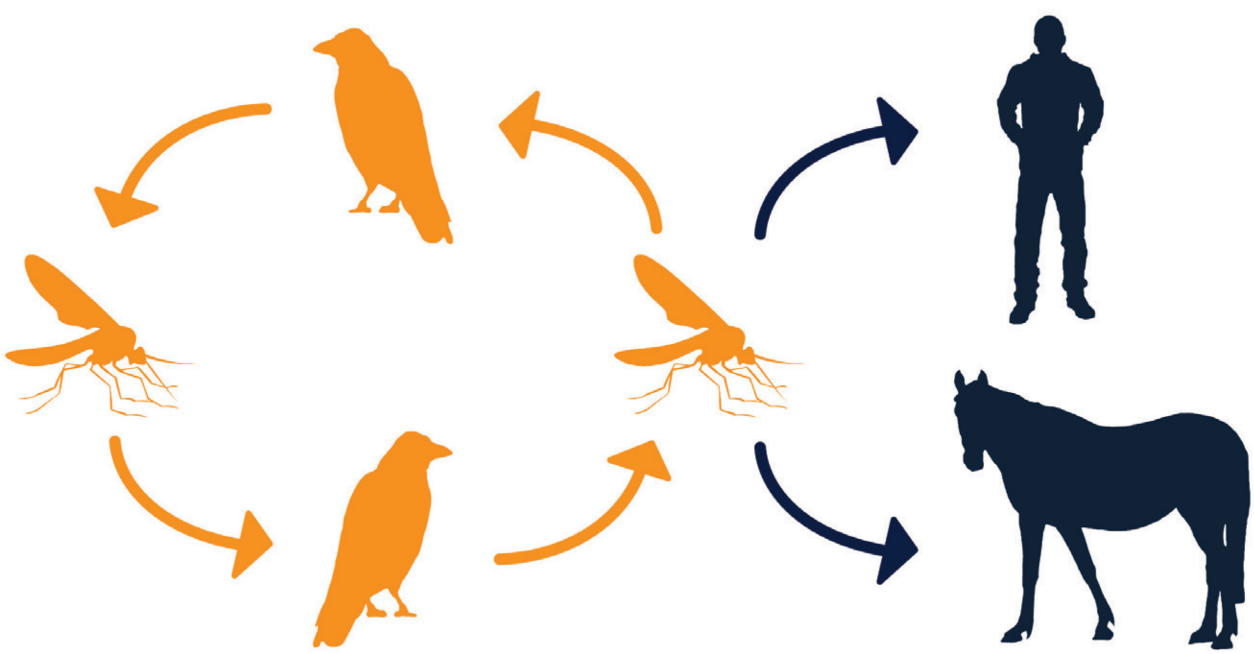
This finding leaves a pressing question: What mosquito is moving the virus from birds to humans? A new possibility is emerging. Research at USU has detected a newcomer in northern Utah—the southern house mosquito (*Culex quinquefasciatus*), previously more common in warmer regions. Its numbers are increasing in northern Utah, and it has demonstrated the ability to survive insecticides that are commonly used in this region. The southern house mosquito feeds on both birds and mammals—making it a bridge vector capable of transferring WNV from birds to humans. Its growing presence may help explain recent human infections in areas where mosquitoes feed almost exclusively on birds.

As species like *C. quinquefasciatus* expand their range northward, feeding on both birds and mammals, they may be quietly bridging the gap of disease transmission between songbirds like house finches and unsuspecting humans in neighborhoods across Utah. The virus does not need wetlands to thrive; it happily moves through its transmission cycle in storm drains, overwatered lawns, bird baths, potted plants, and backyard trees where birds perch and mosquitoes breed.

Keeping WNV at bay will require more than just traps and sprays—it will take community awareness, careful water management, and continued research into how and where these mosquitoes are moving. By dumping out standing water, fixing irrigation leaks, keeping our doors and windows screened, using insect repellent, and supporting local mosquito abatement programs, we can all play a role in interrupting the cycle of disease transmission and protecting both human and wildlife health.

Transmission of West Nile Virus

The virus spreads in a continuous cycle from mosquitoes to birds. Mosquitoes can also spread the virus to humans and other mammals, but cannot pick the virus up from them. Thus, birds are "amplifying hosts" and mammals are "dead end" hosts.



Fungicide Resistance in Home Gardens, Fields, and Orchards

Chemicals have been successfully used for decades to control fungal pathogens. Currently there are fungicides on the market belonging over 40 different chemical groups. The chemical groups are classified based on what part of the fungal physiology they target. Some chemical groups target a fungus at multiple points in its physiology, others only at one point. Chemical groups that target a single aspect of the fungal physiology are typically highly effective but are also at high risk for resistance development.

Numerous fungi have developed resistance to chemical including those in the demethylation inhibitor group (DMI or triazoles, Group 3) and quinone outside inhibitors group (QoI or strobilurins, Group 11), making these fungicides less effective.

Fungicide resistance develops when fungicides from the same chemical group are used continuously without alternating to a fungicide from another chemical group. A mutation in the gene that codes for the fungicide target can alter the fungal metabolism allowing the fungus to continue its lifecycle without interruption after the fungicide was applied. By using chemicals from the same group over and over, fungal individuals with an immune-type mutation increase in population while the individuals without the mutation are killed. This may not be obvious initially, but over a couple of years the population of a specific fungus in a garden, field, or orchard will consist of nearly 100% resistant individuals.

Every year, I receive inquiries stating that the fungicides they used for necrotic ring spot in their lawns or powdery mildew in their fields did not provide control. These applicators have typically used fungicides from the same chemical group for several years, which could account for the poor control.

Necrotic ringspot in turf that does not respond to a certain fungicide may be resistant.
Image courtesy Mary Ann Hansen, Virginia Polytechnic Institute and State University, bugwood.org

It is important to follow the recommendations on the pesticide label. Most fungicides include the chemical class on the first page of the label as well as the maximum number of sprays or material that can be applied per season. This information is provided to prevent the development of resistance. Following the label and alternating with fungicides from different chemical groups does not only the benefit the applicator's farm. Fungal spores travel for miles and spores from resistant individuals can infect plants on neighboring farms. The owner of that farm may use a recommended fungicide without realizing that they already have resistance when it was not their fault.

To prevent fungicide resistance, it is essential to follow the instructions on the label and alternate between products from different chemical groups. If we lose the effectiveness of good fungicides due to resistance without alternative control strategies, millions of dollars in crop losses could be the result.

— Claudia Nischwitz, Plant Pathologist

Insect Strategies to Survive Fluctuating Temperatures

AI image generated by Adobe Firefly.

Insect internal body temperatures fluctuate depending on the environment (insects are poikilotherms). Indeed, they are cold-blooded animals and most of them cannot generate their own body heat. You may wonder how insects survive winter, knowing that they don't wear warm clothes or live in cozy houses with heaters. To mitigate the effect of unfavorable environmental conditions, insects have developed a diverse variety of strategies to overcome harsh conditions and warm up their bodies.

Slowing it Down

Three important terms that are often used interchangeably, but have different meanings are dormancy, quiescence, and diapause.

- *Dormancy* is an inactive state characterized by suppressed metabolism leading to reduced growth, development, and reproduction. In other words, dormancy is like hibernation in warm-blooded animals such as bears and groundhogs. Dormancy may include diapause or quiescence.
- *Quiescence* is an immediate and reversible state of suppressed metabolism imposed by adverse conditions (temperature, moisture, or nutrition). Quiescence ceases as soon as favorable conditions return.
- *Diapause* is a hormonally-regulated state of low metabolic activity that is genetically determined to occur during a certain life stage. Similar to quiescence, diapause is a response to environmental cues, but it is triggered before adverse conditions occur. It is a gradual change perceived by insects through stimuli such as shortening days, cooler temperatures, or lower food quality.

Surviving Freezing Temperatures

Insects' most common strategy to avoid cold conditions is to migrate to warmer places. For instance, the emblematic monarch butterfly migrates thousands of miles to Mexico to overwinter. Other insects are less "brave" and seek out nearby protected sites, giving them a more stable environment (like soil, debris, litter, building structures) in preparation for diapause. A famous example is the convergent lady beetle that find its way to our sheds, attics, garages, or even inside our houses and form aggregations to stay warm.

Wherever they land for the winter, insects may use either freeze avoidance or freeze tolerance to survive.

- Freeze avoidance involves the accumulation of antifreeze and heat shock protein in insect cells. The antifreeze is made of specialized

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carbohydrates called cryoprotectants, which lower the body's freezing point, preventing body fluids from freezing. These insects can survive lower temperatures (-20 to -40°F) by lowering the point at which water freezes in their body.

- Freeze tolerance involves the production of ice-nucleating proteins, which increase the accumulation of cryoprotectants in the body. Without this adaptation, ice crystals may form inside the insect's body at freezing temperatures, causing body expansion, cell bursts, and organ damage. Insects using a freeze-tolerant strategy will experience higher mortality at low temperatures (-40°F) by limiting the presence of ice in their body.

Warming Up

In spring, when conditions are more favorable, insects start to emerge and can exhibit several behaviors to warm up their body. Some species adjust their posture towards the sun to maximize radiative heat gain; this is called basking. This behavior has been observed in dragonflies, ants, grasshoppers, cicadas, and butterflies. In butterflies, heat is accumulated by spreading the wings (dorsal basking) or by closing them and rotating to maximize solar input laterally (lateral basking).

Bees and bumblebees warm up by contracting their flight muscles without moving their wings, similar to shivering in humans.

Another way for insects to collect heat is by using heat accumulated in the substrate. Heat is transferred to the insects through both conduction and radiation. For instance, 'flanking' has been observed in grasshoppers when they lay on their side to warm up.

AI image generated by Adobe Firefly.

Summary

Temperature is a critical factor for insect development and reproduction, but insects have evolved multiple strategies to survive harsh conditions. A warm winter (i.e., lower numbers of days with freezing temperatures) can reduce insect mortality, leading to higher survival of overwintering populations. Additionally, warmer temperatures in spring can lead to early pest emergence, resulting in asynchronous cycles between the insect life and the crops. Many research-based studies have shown that insects are moving northward with warming temperatures, increasing pest expansion range, and creating new pest problems in areas that were previously too cold for them to survive.

— Emilie Demard, Extension Entomologist

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Wheat Stem Sawfly: An Emerging Threat in Northern Utah

The wheat stem sawfly (*Cephus cinctus*) is a major pest of wheat in the Northern Great Plains, particularly in Montana, Canadian Prairies, and surrounding states. In recent years, it has expanded westward into Idaho, Washington, and potentially Utah. There have also been several sawfly problems reported in Nebraska and Colorado, which is urging researchers to study this pest.

The sawfly larva feeds inside the wheat stem, causing lodging and yield losses, complicating harvest, and threatening wheat profitability. In Montana alone, annual losses exceed $80 million, and across the Great Plains, they reach $350 million. While there is no formal report or scientific study on this pest in Utah, anecdotal evidence from several wheat fields in northern Utah (Box Elder and Cache counties) suggest wheat damage from this pest.

What does it look like?

Adults are small (5/16 to 3/4 inch) wasp-like insects with black heads, yellow legs and abdominal markings, and smoky wings. Larvae are creamy white, S-shaped with black heads, feeding inside stems and weakening plants. The larva is the main stage that damages wheat and causes yield loss. They notch the stem base before overwintering, causing stems to lodge and reducing harvest efficiency.

What is its life cycle?

Wheat stem sawfly typically has one generation per year. In spring, overwintered larvae pupate within the sealed cocoon in wheat stubble, and adults begin flight in May–June when temperatures exceed

Adult female wheat stem sawfly.
Image courtesy RKD Peterson, Montana State University.

50–62°F. Females live for about one week. They lay eggs (typically one per stem to avoid cannibalism) inside healthy elongated wheat stems, and the larvae feed by tunneling through the stem in the summer. When the crop matures, the mature larva moves down toward the base of the stem or stubble to overwinter in diapause.

How is this pest monitored?

Wheat stem sawfly adults are not strong fliers. Hence, their infestations are typically more severe on edges of wheat fields adjacent to fields infested in previous years.

- Focus on sweep-netting the field borders during late May through July when adults are active.
- During summer, split the randomly collect mature wheat stems to check for larvae, frass, and tunneling inside the stems.
- After harvest, inspect wheat stubble for overwintering larvae.

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What are the management strategies?

Preliminary observations suggest possible sawfly damage in parts of northern Utah, but formal surveys are lacking. The Adhikari lab plans to systematically survey wheat fields for sawflies and develop strategies to enhance natural enemy populations as part of an IPM program.

Cultural controls: Planting solid-stem wheat varieties in high-risk fields is currently the most effective way of managing this pest. This practice can reduce wheat stem sawfly larval survival by up to 40%. If more than 15–20% of stems were cut in the previous season, growers should consider control strategies for next season, especially planting solid-stem wheat varieties. Similarly, rotating crops (e.g., safflower, legumes, oats) to avoid issues from infested wheat stubble and planting trap crops such as oats, rye, or barley along field edges could help manage sawflies. Studies have shown that residue management by leaving 75% or more stubble and avoiding burning or baling can help support parasitoids of sawflies. Tillage can reduce overwintering sawfly larvae but may conflict with soil health goals.

Biological Controls: Native parasitoids (*Bracon cephi* and *B. lissogaster*) attack larvae inside wheat stems. These wasps locate sawfly larvae, paralyze them, and lay eggs that hatch and consume the host. Parasitoid habitat can be enhanced by leaving residue and diversifying crops with cover crops or flower strips. Research in Montana suggests that achieving 30% parasitism through improved habitat management or farming practices could yield over $11 million in pest regulation benefits.

Lodging by wheat stem sawfly damage observed in a wheat field in northern Utah.
Image courtesy F. Sabadin, Utah State University.

Chemical Controls: For the action threshold, if 15–20% or more stems were cut last season, management should be planned for sawfly control for next year. Foliar insecticides can be applied but are mostly ineffective because larvae are protected inside stems while the adults fly for only one week. Sprays are generally not cost-effective for wheat, can harm beneficial parasitoids, and disrupt conservation biological control.

Tips for 2026

- Monitor adult emergence and egg-laying from late May to early July.
- Dissect wheat stems to detect S-shaped larvae and frass in lodged or broken plants.
- Use solid-stem wheat in infested areas.
- Avoid planting wheat next to last year's infested fields.
- Consider oat trap crops along borders.
- Harvest early in heavily infested fields to reduce lodging losses and stem breakage.
- Leave residue to conserve parasitoids.

— Subodh Adhikari, Extension Entomologist

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Pesticide Label Changes for ESA

Part 3: Using the Look-up Tool, Bulletins Live! Two

This article is the final in a series discussing upcoming pesticide label changes for Utah agriculture to comply with the Endangered Species Act.

Several agricultural pesticide labels now include a new section under *Directions for Use* called "Endangered and Threatened Species Protection Requirements." When this appears on a label, it means the product's active ingredient has application restrictions in areas where endangered species are present. The label will instruct applicators to consult Bulletins Live! Two.

What is Bulletins Live! Two?

Bulletins Live! Two (BLT) is a web tool developed by the U.S. Environmental Protection Agency (EPA) to better comply with the Endangered Species Act (ESA). It allows EPA to update application restrictions for pesticides and locations without issuing new labels each time.

Within BLT, a national map displays highlighted areas where endangered species or their habitats occur. These highlighted zones are called Pesticide Use Limitation Areas (PULAs). Each PULA has its own pesticide-specific restrictions, provided in a downloadable bulletin. A bulletin is a PDF document that serves as an extension of the pesticide label. Because endangered species information changes over time, the EPA may update bulletins as new science becomes available or as species listings change.

The Applicator's Requirements

All agricultural pesticide applicators must visit BLT if the label instructs. This means generating and saving a bulletin for the spray area, even if it shows no restrictions.

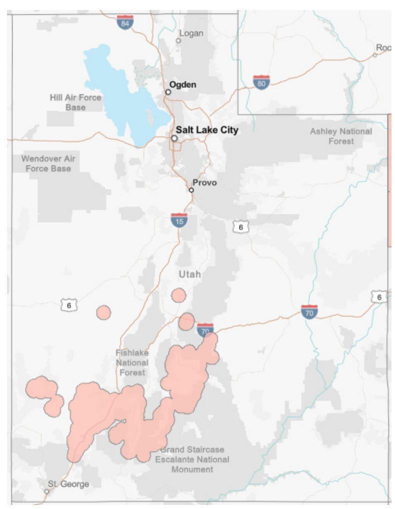
As of 2025, Utah has one PULA, established to protect the Utah prairie dog in the southwest part of the state. Eight active ingredients carry restrictions in this PULA, all of which are formulated as fumigant cartridges, such as The Giant Destroyer, Smoke 'Em, and Amdro Gopher Gasser.

For Utah farms not located in a PULA, we recommend checking BLT each spring and generating one bulletin (typically blank) for each month of your spray season. These can be produced up to six months in advance and saved for your pesticide application records.

Do the label changes apply to me?
The updated requirements applies to anyone spraying conventional (non-organic) pesticides on agricultural lands (row crops, specialty crops, orchards, vineyards, Christmas trees, sod farms, and flooded crops). It does not apply to sprays of turf, ornamentals, greenhouses, nurseries, or residential sites.

Does Utah have endangered species?
Yes, approximately 45. These include birds such as the California condor and Gunnison sage-grouse, fish such as humpback chub, plants such as dwarf bear-poppy and Navajo sedge, insects such as the nokomis fritillary, mammals such as the black-footed ferret and Utah prairie dog, and reptiles such as the desert tortoise.

How to Use BLT



1. Open Bulletins Live! Two and zoom in on Utah. Allow time for the initial map and detailed state map to load.
2. On the left panel, select the month when the application will occur. The Bulletin must be dated before the application.
3. Zoom to your farm or field location and click on the map. You may also search by ZIP code or enter geographic coordinates and your planned application date.
4. Watch the "Printable Bulletin" box in the upper-right corner. When it turns from red to green, click the link to download the bulletin file it with your pesticide records.

— Marion Murray, IPM Specialist

IPM In The News

Parasitoid Wasp Targets Soybean Gall Midge

Soybean gall midge (SGM) is a newer pest of soybeans in the Upper Midwest of the U.S. Its feeding on stems can significantly reduce yields. Researchers at the University of Nebraska–Lincoln discovered a wasp, *Synopeas ruficoxum*, living alongside SGM during their monitoring practices. The wasp was confirmed to be a beneficial parasitoid of SGM and this discovery, published in the *Journal of Hymenoptera Research*, has prompted further study to understand the wasp's biology and its potential as a natural biocontrol agent.

Mulching Effects in Artichoke Production

Published in the *European Journal of Agronomy*, researchers at Rodale Institute investigated the impact of living mulch and plastic mulch on soil health, weed suppression, and yield in organic globe artichoke systems. The team tested living mulches such as white and crimson clover, kurapia, and a buckwheat-pea system, against a standard plastic mulch. The findings from the study show that while living mulches significantly increase soil health and showed early weed suppression, artichoke yield was reduced. In contrast, plastic mulch and kurapia increased yield with minimal soil health benefits. These findings highlight the trade-offs between productivity and soil conservation, suggesting that combining approaches may optimize both yield and long-term soil sustainability.

Improving Beneficial Nematode Storage Life

Application of beneficial nematodes is an important management tool for soil-dwelling pests such as corn rootworm and fungus gnats. Commercial formulations of nematodes have short shelf lives, which complicates shipping and application timing when weather is not conducive for application. Researchers at Cornell and Persistent BioControl developed a new formulation and holding medium that allows beneficial nematodes targeting soil pests to be stored longer, shipped farther, and more readily-mixed. The innovation enables growers to apply biological controls more effectively and reliably, reducing dependency on chemical insecticides.

Global Shift to Sustainable Pest Management

As global agriculture faces increasing pressures from pest resistance and environmental concerns, a team of researchers headed by University of Bonn surveyed international experts to assess the potential impacts of adopting ecologically based, sustainable pest management strategies. Results from the survey, published in *Nature Communications*, predicted substantial environmental benefits, with experts in Asia, Africa, and South America also forecasting positive economic impacts. North America, Europe, and Australia expected mixed economic outcomes with some stating a potential for reduced profits for farmers. Overall, the study concludes that sustainable pest strategies could improve human and environmental health while increasing access to safer food worldwide.

Genetic Discovery Advances Insect Pest Control

Pest management sometimes includes a strategy known as the sterile insect technique (SIT), which involves releasing sterile males of a target pest into the natural population to prevent reproduction and reduce the population. The effectiveness of this strategy relies on the accurate separation of sexes during the rearing process, limiting its productivity. Recently, an international team of researchers

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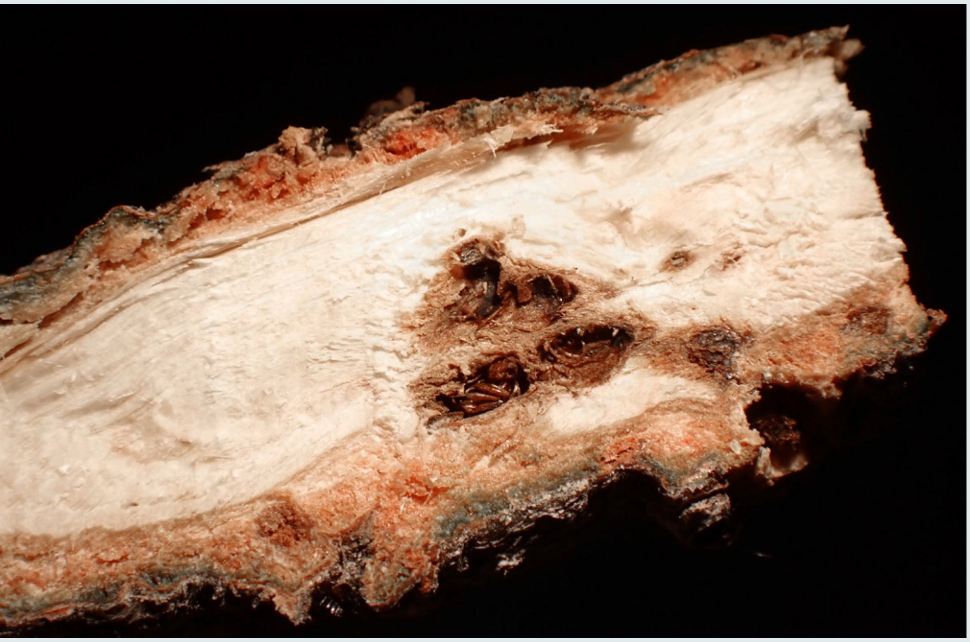
Featured Picture of the Quarter



An interesting type of Cynipid wasp is the oak twig wasp, *Bassettia* sp. Females lay eggs inside the tissue of small twigs. As the larva feeds, a tiny cell forms around its body, allowing the larva to develop into an adult. The image to the left shows a cluster of 5 wasps but there can be as many as 100 in a tight-knit group.

Dieback of twigs may occur that signals infestation, but galls will not be visible. Instead, look for their tiny, round edit holes or slice stems open to see their chambers.

— Image by Megan Kast, IPM Associate

IPM in the News, continued

led by Justus Liebig University Giessen and the Joint FAO/IAEA Centre identified a gene in Mediterranean fruit flies that triggers male-only development after brief heat exposure. Similar genes are present in many insect species, making this gene discovery, published in *Applied Biological Sciences*, a promising target for SIT.

Nanotechnology as Pest Control

Researchers at Agriculture Canada are studying how nanotechnology can improve genetic pest control by enabling the delivery of highly targeted treatments to insect pests. Many insecticides affect a broad spectrum of insects, which can lead to unintended declines in beneficial species and cause harm to crops.

The team's research focuses on using nanoparticles to transport genetic or molecular agents, such as RNA-based tools, into specific pests, allowing precise targeting of individual species and closely related insects. Although still in the early stages, this technology could help address pesticide resistance and support more sustainable crop protection.

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Extension UtahStateUniversity
NPDN National Plant Diagnostic Network
WPDN Western Plant Diagnostic Network
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USDA United States Department of Agriculture National Institute of Food and Agriculture