College of Agriculture and Life Sciences
Arizona
Cooperative Extension

Backyards & Beyond

Summer 2012 RURAL LIVING IN ARIZONA Volume 6, Number 2

Featured Plant

Common Name: Wholeleaf Indian paintbrush
Scientific Name: *Castilleja integra*

Sue Smith

Susan Pater, Area Extension Agent, 4-H Youth Development, University of Arizona Cooperative Extension, Cochise County

A spike of showy, reddish-orange bracts generally calls our attention to this paintbrush. The showy color of the paintbrush plant is produced by the bracts (modified leaves) that occur in a variety of colors. The greenish, tinged scarlet, tubular true flowers are inconspicuously hidden among the bracts. "Integra", Latin for "whole", refers to the bracts and leaves which are not incised or lobed as in many other species of *Castilleja*. *Castilleja integra* is a perennial and is one of about 200 species of the genus *Castilleja* in the family of Scrophulariaceae (Figwort or Snapdragon Family). It grows to a maximum of about twenty inches tall. The plant ranges through the southwest in Pinyon/Juniper and Ponderosa forest communities at elevations of 3000 to 7500 feet. Indian paintbrush was adopted as Wyoming's state flower in 1917.

Indian paintbrush plants are partially parasitic. The plant takes water and nutrients from the roots of other native wildflowers, shrubs, and grasses via finger-like projections of parasitic tissue called *haustoria*, which grow from the roots of the paintbrush and penetrate the roots of the host plant. They do not completely deplete the nutrients from the host plant, although it often does take a toll on its fitness and growth. *Castilleja* species are generalist parasites - they do not require a particular host species; however, you will often find paintbrush growing together with bunchgrass, chamise, sagebrush, lupine and wild buckwheat.

The flowers of Indian paintbrush are edible and sweet, but must be eaten in small quantities. These plants have a tendency to absorb and concentrate selenium in their tissues from the soils in which they grow, and can be potentially very toxic if the roots or green parts of the plant are consumed. Various Native American tribes used the flowering parts as a paintbrush, as well as an ingredient in paints and dyes. The Chippewa Indians are known to have used the Indian paintbrush as a medicine to treat rheumatism and as a bath rinse to make their hair glossy.

Featured Bird

Common Name: Lucy's Warbler
Scientific Name: *Vermivora luciae*

Dan L. Fischer

Dan L. Fischer - Author of *Early Southwest Ornithologists*, *1738-1900*, University of Arizona Press

The end of March marks the time of growth and renewal in the lower deserts of Arizona. When adequate winter rains and temperatures have occurred, a whole array of plants emerge or burst forth. Some annuals may begin a gorgeous floral display while early cactus buds follow on certain species, and some even begin showing lavish flowers. Along the washes and dry stream courses, leaves develop on the large mesquite and shrubs. In April and May the blue palo verde begins a glorious show of intense yellow blossoms which is quickly followed by the foothills palo verde in a massive and widespread panorama of pale yellow.

At this same time among the larger mesquite thickets, an assemblage of avian species burst forth in song which includes Lucy's Warbler, just returning on migration from Mexico. As the smallest of our wood warblers, it would hardly be noticed were it not for its loud, distinct, sweet song that is delivered almost incessantly in early spring. They are tiny pale gray birds, just over four inches, with the male showing a reddish chestnut cap and rump as they probe the branches and leaves for insects. Nesting begins almost immediately as sites are selected mainly among mesquite, sometimes palo verde, occasionally ironwood and less commonly in trees slightly higher in elevation. Generally four creamy-white eggs, speckled with reddish-brown are laid in cavities or in partially concealed tree bark or split branches. Sometimes two broods are reared before returning to Mexico.

The discovery of Lucy's Warbler in 1861 was made by Dr. J. G. Cooper (1830-1902) while posted at Fort Mojave, located on the east side of the Colorado River near latitude 35°. He was first attracted to the warbler "by their notes, as their small size and concealment in the dense mesquite thickets...would have prevented their discovery." Cooper was a great admirer of Spencer Fullerton Baird (1823-1887), Secretary of the Smithsonian Institution and the central figure regarding the natural sciences in the country at that time. It was because of this lasting friendship that Cooper applied the scientific and common names to this bird in honor of Baird's daughter Lucy Hunter, who was only thirteen at the time. The Cooper Ornithological Society was later named in his honor for his many notable contributions to science.

The late 1800s brought forth a great interest and advancement to science in the little known wilderness of Arizona and indeed, the entire Southwest. The competitive but respectful spirit, seriousness, and discovery of the local bird life among many individuals was very high as three other men noted this elusive warbler in quick succession. The first was a Mr. Holden near the 34th parallel in 1863, then two notable army officers, Dr. Elliott Coues at Fort Whipple north of Prescott in 1865, and Lt. Charles Bendire close to Camp Lowell near Tucson in 1872. The two army officers, like Dr. Cooper, in addition to their military assignments, became prominent ornithologists through their common interest and close association with Baird.

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Tyler Fox

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Cover Photo credit: Norman Cooper

Rusty Dodson

CAPTURING MOTHER NATURE'S FIREWORKS

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Tracy Hardy

Eric Larsen

The monsoon season in Arizona which typically runs from early July to late September brings spectacular lightning shows or "Mother Nature's fireworks." It is awe inspiring and breathtaking for both the young and old. And just like fireworks on the Fourth of July, lightning flashing across the sky or between sky and ground can make for some fabulous photographs. Capturing that flash of light on your camera is an art, but can be done by anyone that has a camera with a few key settings.

Please note lightning is very unpredictable, which is why it is very DANGEROUS and safety needs to be an important part of your plan when taking photographs of lightning. The storm may seem miles away but the lightning might not be. Two places that are relatively safe for shooting pictures are within your house near a window or from within a hard topped vehicle. If taking photos through a window, make sure to turn off all lights inside to reduce reflections. Please visit the following website for more information on lightning safety before you venture out to take your photographs: National Weather Service - http://www.lightningsafety.noaa.gov/overview.htm

The following are two types of digital cameras discussed throughout this article:

1) SLR (Single-Lens Reflex) – This type of camera will have a "B" or Bulb function and will allow you to manually adjust the focus, exposure, aperture, and ISO settings.

2) Compact Camera (point-and-shoot) – It is important that your camera has the ability to force the focus to infinity and keep the shutter open for at least 10 to 30 seconds or has a fireworks setting. The fireworks setting usually turns the flash to off, sets autofocus to infinity and exposure compensation to off, bumps down the shutter speed and aperture, and lowers the ISO.

The following tips will help you prepare yourself and your equipment to capture your next award winning lightning photograph.

GET TO KNOW YOUR CAMERA SETTINGS AHEAD OF TIME

A lightning session may come and go quickly. The storm might not leave time to look up settings and how to adjust them. Know your camera and how to adjust your camera ahead of time. It's a good idea to practice making adjustments in the dark. But, just in case, or if you have a special circumstance arise, be sure to have a small flashlight with you. If you are taking photos with someone else be aware that your flashlight could possibly ruin their photo, so be careful when turning on a light.

FIND A SUITABLE LOCATION

It is very important to keep SAFETY in mind when selecting a location to setup your camera equipment. Remember that no place outdoors is safe when thunderstorms are in your area. Lightning can strike without warning many miles out ahead of thunderstorms. Select a location that has an unbroken view of the dark sky. It's very difficult to aim your lens at a small view of the sky and think that a strike of lightning will happen right there. Have a broad expanse that you can capture, and then crop to the composition you like with your computer or, when you see the

location where lightning is striking, zoom in on that location. The location should have low levels of ambient light close to the camera. Street lights miles away won't affect your shot as much as one within 100 feet of your location. If the camera picks up light nearby, it can ruin the photo. The location ideally should provide protection, both for your camera equipment and for the photographer. Rain moisture can get into cameras and lightning can kill. So pick a safe location!

USE A TRIPOD

You will be using a long exposure setting (10 seconds to 1 minute) on your camera. You cannot possibly hold it still for that exposure time. A tripod will help prevent blurred pictures. Keep in mind that you can still utilize a tripod within a vehicle in the passenger seat or utilize a system that clamps onto your window.

SHOOT AT NIGHT

By shooting at night, you can use a long exposure to capture the lightning. Daytime lightning photography requires specialized equipment that can be expensive. When shooting at night, be sure to bring a flash light, so you can see not only where you are walking but also the buttons on your camera. Flashlights that have a red light or a red lens are very useful because you can leave your red light on and not affect your pictures.

FOCUSING THE LENS

Set the focus on your camera to infinity. Your camera cannot focus quickly enough if left on automatic focus and your auto focus will continue to search for a focus subject. Check your cameras owner's manual to find out how to set your focus to infinity. SLR cameras have a switch on the lens or in the cameras menu labeled AF (Autofocus) and MF (Manual Focus); switch it so it is on MF. Some compact digital cameras have an option to force the focus to infinity or you can utilize the landscape picture setting sometimes symbolized as a mountain and tree.

BULB FUNCTION & REMOTE SHUTTER RELEASE

Change the shutter speed setting on your camera to "B" or Bulb function. This function allows the shutter to stay open for prolonged periods of time. When you hold the shutter button down it opens the shutter until you release the button. For both SLR and Compact Camera's reference your cameras owner's manual. Most Compact Cameras do not have a Bulb function. In that case set your exposer time to the longest possible setting, this will most likely be thirty seconds. Keep in mind that you will have to push your shutter button after each time the exposure ends.

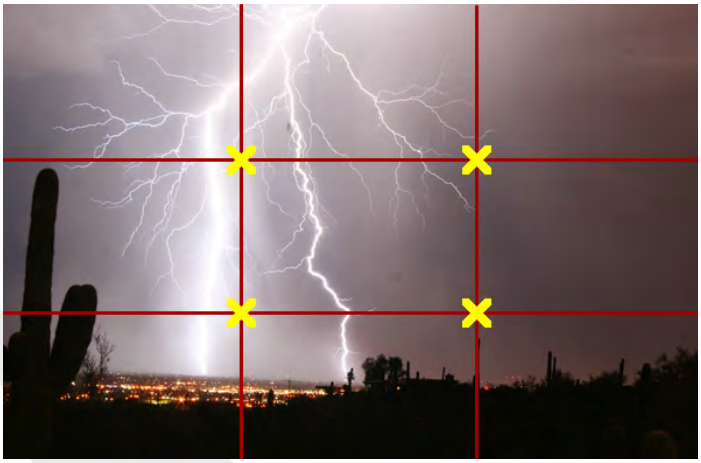
A remote shutter release allows you to start the exposure without having to "push the button". This reduces the amount of "jiggle" that occurs from the force of pushing the button. The remote shutter release allows you to determine when you want to end the exposure. Longer exposure time allows you to get more strikes into a photo, which makes for a cool effect on your final product.

STARTING POINTS FOR OTHER CAMERA SETTINGS

You should set your cameras settings to the following as a starting point; the ISO should be at 200, f-stop at f/2.8 - f/8. The f-stop you choose depends on how distant the lightning is, how bright the lightning is, and your personal preference. The higher f-stops should be used for distant lightning (greater than 25 miles away), when used on closer lightning will result in a thinner channel than the lower f-stops.

COMPOSITION

Just because the bolt of lightning is your main subject, you can't forget to compose your photo. Be sure to watch for power lines and poles. You may not notice them at night, but they will show up as black lines and detract from the photo. Look for strong features in the foreground that may silhouette with the flash from the lightning, keeping mind the rule of thirds. The rule of thirds is a composition technique. Imagine your image is divided into thirds, both horizontally and vertically, into nine equal parts. The rule of thirds tells us to place the most important elements of the image where the lines intersect. In this photo the landscape is in the lower third with the brightest bolt of lightning near the left vertical line. A common technique when photographing lightning is to have the horizon at the bottom of the photo and include as much sky as possible.



Tracy Hardy

PROTECT YOUR GEAR

Protect your camera equipment from the elements, no use exposing expensive equipment to a downpour. Consider purchasing an inexpensive rain cover for your camera. Establish a dry area where you can change your lenses, preferably you should change your lens indoors to avoid dust and moisture. Utilize your vehicle if you are away from your house or a building. Remember – Safety First! No place outdoors is safe.

BE PATIENT

Lightning may come and go quickly from the location you are taking pictures. It might keep wandering around an area, always avoiding the direction of your lens. That perfect bolt might come as you are between exposures. You can't "plan a date" with lightning – it happens when and where it happens and you have to try to be ready. It's not like taking photos of animals at the zoo when you can plan to go there and you know there will be subjects available. Going back to the first step, it is always helpful to get to know your camera settings ahead of time so you can capture a prize winning photograph.

Lightning photography takes some practice and trial and error to find out what works with your camera. If you would like more information on lightning photography you can purchase a copy of the 4-H Lightning Photography curriculum called "Catch the Spark!" either online at http://cals.arizona.edu/4hsales or you can call toll free (877) 763-5315, Monday through Friday 1:00 pm to 4:30 pm. Search for or ask for Publication #: 4HAZ1511, cost is $2.00 plus shipping and handling.

Waiting for the Rain:
Tracking Drought Status across Arizona

Summer Waters, Extension Agent, Water Resources, Maricopa County and Michael Crimmins, Ph.D.,
Climate Science Extension Specialist, Soil, Water and Environmental Science Department, University of Arizona

Arizona has two distinct 'wet' seasons that bring most of the annual total precipitation to the region; the winter and summer. The summer monsoon season is probably the most anticipated season in part because it brings exciting thunderstorm activity and welcome relief from the relentless heat. Summer precipitation during the monsoon season also delivers water critical to ecosystems and agricultural production systems including ranching and dryland farming. However, decades of drought and some disappointing monsoon seasons in recent years have left people across the state wondering if the rain would really show up this summer. Could the monsoon season bring enough rain to end this drought and revive rural Arizona? While it could certainly provide some short-term relief from the dry conditions across Arizona, the summer precipitation is only one piece of a complex climate puzzle. This article provides a look at recent history, an overview of the current drought status maps, and links to additional resources. This information can help you better understand the drought we are all experiencing, the role of government agencies in drought preparedness, and what actions you can take in order to adapt to these conditions; whether in the short-term or long-term.

BACKGROUND

In 2003 the Governor of Arizona declared a drought emergency and established the Governor's Drought Task Force (Task Force). The Governor directed the Arizona Department of Water Resources (ADWR) to provide statewide leadership in this effort with an emphasis on providing assistance to rural communities with potable water supply needs and developing longer-term drought preparedness and response plans. The Task Force sought to accomplish this by focusing on drought monitoring, improving drought status and water conservation communication, building capacity in conducting drought planning and drought emergency coordination, and encouraging actions which could potentially mitigate the economic and social impacts of drought. This approach relies on effective scientific monitoring of drought conditions and stakeholder engagement. Monitoring drought status is the backbone of the Arizona Drought Preparedness Plan, bringing state, federal and local agencies together to report Arizona's drought status. Drought status maps provide up-to-date information about the severity of drought in different watersheds and/or counties. Anyone can use them to find out more about drought conditions and prepare to cope with drought impacts on plants, animals, and water supplies.

IS ARIZONA EXPERIENCING DROUGHT?

Arizona is in the second decade of statewide drought due to long-term precipitation deficits. The 2003 Drought Emergency Declaration issued by the Governor's office has persisted into 2012, and many counties have had drought disaster determinations by the U.S. Secretary of Agriculture since the late 1990s. The Arizona Department of Water Resources provides statewide leadership in facilitating the Governor's Drought Interagency Coordinating Group and the State Drought Monitoring Technical Committee (MTC) in order to assess Arizona's drought conditions. The MTC analyzes data and observations from many organizations in order to determine if the drought status declaration is still accurate and then they post easy-to-interpret maps and information about current drought status. This information enables the public and local leaders to look at the drought conditions in their area over time and make decisions about the future based on the most current data.

HOW IS DROUGHT DETERMINED?

Drought is determined by factors such as precipitation deficit relative to "normal" or average levels, impacts on the environment and agricultural systems. Due to the complexity of how precipitation patterns interact with ecosystems and water resources in Arizona, drought conditions can exist at multiple timescales all at once. It may take several years of below-average precipitation to impact a large-scale reservoir system (long-term drought impact), while one unusually dry monsoon season can dramatically impact rangeland conditions across the state (short-term drought impact). In Arizona, the MTC works with authors for the U.S. Drought Monitor to determine short-term drought status by interpreting recent weather conditions and impacts that respond to precipitation over the course of several days to one month. The MTC determines long-term drought status on a quarterly basis by analyzing precipitation data in a manner that considers changes over many months to years. Long-term records (often greater than 30 years in length) of precipitation and streamflow are needed to assess whether current conditions are unusual with respect to the historical record. Observations from field experts on conditions of the local ranges or plant health are also used in creating the drought status maps for Arizona. Drought status maps are available online and updated on a regular basis so Arizonans can be informed about drought status and water supply conditions.

U.S. DROUGHT MONITOR MAP

The Drought Monitor map (available at http://droughtmonitor.unl.edu) is the only official drought monitoring product recognized by USDA and used for making decisions regarding USDA drought relief programs. It is released weekly (every Thursday) and represents data collected through the previous Tuesday. The U.S. Drought Monitor is an assessment of recent conditions and drought status developed as a collaborative effort between federal agencies and academic partners. The U.S. Drought Monitor maps are based on a mix of measured and descriptive data, including (but not limited to) the Palmer Drought Severity Index, soil moisture, streamflow, precipitation, and measures of vegetation stress, as well as assessments of drought impacts.

ARIZONA DROUGHT STATUS UPDATES

Each week, ADWR posts the U.S. Drought Monitor's map of Arizona on their website. A short-term drought status report is written at the beginning of each month to provide a more in depth review of conditions in Arizona. The short-term drought status update report is a brief summary of recent weather conditions across the state and their impact on the overall drought

status. Observations received from citizen scientists and other collaborators are an important source of input to this update.

Arizona's long-term drought status map is updated quarterly. The drought status is determined by comparing the precipitation and streamflow percentiles for the past 24, 36 and 48 months to a 40-year historical record. The resulting map uses the same key as the US Drought Monitor. However, the long- term drought status map is displayed by watershed, unlike other maps that show drought status by county. This is important because a watershed defines the area of land that carries precipitation to a particular stream or river. One watershed may span several counties. As a result, counties may need to work together in order to effectively prepare for long-term drought impacts on local surface water resources.

Each fall, the ADWR also releases an Arizona Drought Preparedness Annual Report that summarizes drought conditions and drought preparedness activities for the water year (October 1 - September 30). It includes summaries of winter precipitation, summer precipitation, drought status changes, the water year summary, next year's outlook, drought designations and declarations, requests for resources to enhance drought planning and monitoring, and updates on methodology.

WHERE TO FIND THESE MAPS AND OTHER RESOURCES

The tools described in this article are listed below with the corresponding website where they can be found. The information is designed to fit together so people can find out about drought conditions on different timescales. These can be powerful tools when combined with other information such as temperature and precipitation outlook and streamflow forecasts. Whether you need to cope with the impacts of drought conditions on plants and animals or prepare for long-term drought impacts on your community's surface water supply, this data is available to inform your decision making.

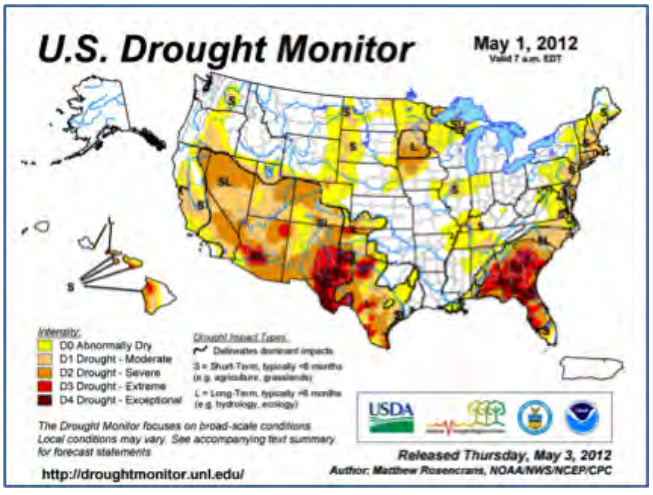
US Drought Monitor Maps
http://droughtmonitor.unl.edu
http://www.drought.gov

Arizona Drought Updates
http://www.azwater.gov/AzDWR/StatewidePlanning/Drought/DroughtStatus2.htm

Climate Summaries and Weather Outlooks
http://www.climas.arizona.edu/outlooks/swco

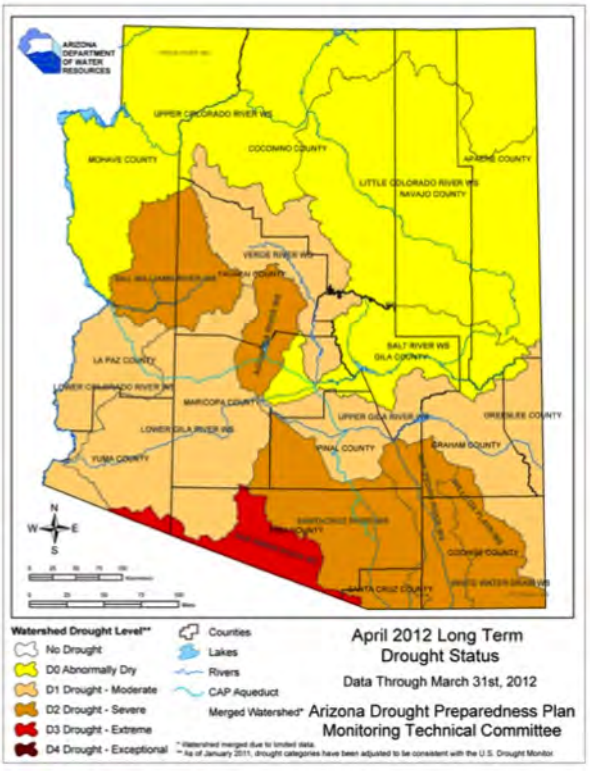
WHAT YOU CAN DO?

Water in Arizona is critical for agriculture, industry, and the natural environment as well as residential and commercial uses. Whether you use surface water (from lakes and reservoirs) or groundwater (from aquifers) it will take time to recover from the deficit that is created by drought. Surface water can replenish in 1-5 years of above-average precipitation, whereas it may much longer for the water table to return to normal after a drought. Drought recovery depends on many factors including the extent and duration of drought. During long-term droughts such as the one Arizona is currently experiencing, everyone can do their part to conserve water and mitigate the impacts of drought. So if we do get plentiful monsoon



How to Interpret the Map
The colors range from light to dark -- which indicate less severe conditions to more severe conditions.

- D0-Abnormally Dry-used for areas showing dryness but not yet in drought, or for areas recovering from drought.
- D1- Moderate Drought
- D2-Severe Drought
- D3-Extreme Drought
- D4-Exceptional Drought



season precipitation, feel free to enjoy the rain, but remember that the current drought won't be over. During long-term droughts everyone can play a role in mitigating the impacts of drought by conserving water and getting involved with community efforts. Here are some ideas for coping with drought impacts:

RESIDENTIAL AND COMMERCIAL LANDSCAPES

SUMMER WATERS

Drought Tolerant Landscape

Landscape with low-water use plants that are adapted to tolerating drought conditions. During drought, water trees first and other mature drought-tolerant plants less frequently. Check your irrigation system regularly for leaks and adjust your irrigation timer seasonally or monthly. If it does rain, be sure to turn off your irrigation system using the rain switch on the irrigation controller. For more information about desert-adapted landscape plants and efficient landscape irrigation go to http://extension.arizona.edu/maricopa/smartscape-program

AGRICULTURE

MICHAEL CRIMMINS

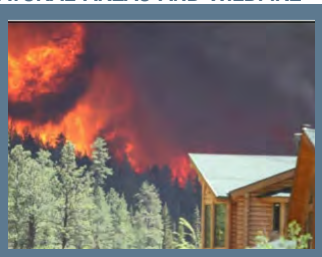
Drought Impacts

Farmers may implement practices such as deficit irrigation to cope with drought, but sometimes loss is inevitable and extreme. When the USDA declares a county a disaster area, funding is available to farmers and ranchers in that county as well as in the contiguous counties. Financial assistance is available to producers when low yields, loss of inventory or conditions prevent planting due to natural disasters as well as producers who suffered grazing losses due to drought or fire in certain circumstances. Contact the USDA Farm Services Agency for more information, or see the online fact sheets online at

http://www.fsa.usda.gov/Internet/FSA_File/nap09.pdf
http://www.fsa.usda.gov/Internet/FSA_File/lfp_2011_pfs.pdf

NATURAL AREAS AND WILDFIRE

JASON COIL



Wildfire Threatens Home

Some communities organize events to clear dried vegetation such as brittle bush from natural areas at the onset of fire season to reduce the risk of wildfires. If your home borders a natural area, to protect it from wildfires make sure that plants near the house are more widely-spaced and lower-growing than those farther away. Check for fire restrictions before burning and never leave any fire unattended. Use the ash tray in your vehicle for cigarette butts if you smoke. For more information go to **http://cals.arizona.edu/firewise.**

ARIZONA DROUGHTWATCH

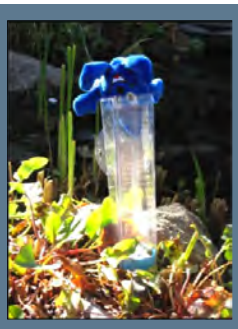
SUMMER WATERS

Volunteer Scientists in Training

DroughtWatch is a monitoring program designed to collect, summarize and display timely observations of drought impacts across Arizona. Observations of local drought impacts are invaluable in properly monitoring and characterizing drought across Arizona's complex landscape. You don't have to be an expert to provide meaningful information. You can seek out local field experts in your community and help get their observations into the online system. Drought impact observations may include reduced stock pond storage, vegetation stress, or low streamflows. Help characterize and monitor changes in drought conditions by reporting drought impacts to http://azdroughtwatch.org.

VOLUNTEER PRECIPITATION MONITORING

PAM JUSTICE



Basin Rain Gauge

Help track precipitation levels and drought conditions throughout the year right in your own backyard! Consider collecting rainfall observations and share them online with programs such as Rainlog.org and the Community Collaborative Rain and Hail Study (CoCoRAHS). These programs help supplement official, but sparse, precipitation observations collected across the state. An observation from your location could help highlight worsening or improving drought conditions missed by the official precipitation monitoring network. Check out http://www.rainlog.org and http://www.cocorahs.org.

WHAT'S NEXT?

On May 10th, 2012 the Governor's Drought Interagency Coordinating Group met to review the data from various agencies regarding drought conditions in Arizona and surface water supplies. Based on the information presented, the group recommended that the Governor's Drought Task Force maintain the drought emergency declaration initially issued in 2003. While the short-term drought status maps indicated some improvement in drought conditions throughout southeastern Arizona, conditions had worsened in central and northeastern Arizona. The long-term drought status maps indicated that all of the state is experiencing some level of drought. To make matters worse, snowpack reported throughout Arizona and in the Colorado River basin was extremely low, so surface water reservoirs will not be replenished by snowmelt from winter precipitation. These worsening drought conditions will make summer rain all the more anticipated in 2012. Summer storms have already made headline news in parts of southern and central Arizona, leaving many with a sense of cautious anticipation…waiting for the rain.

Choosing a Bug Repellent

Dawn Gouge, Associate Professor and Associate Specialist - Urban Entomology
and Carl Olson Associate Curator, Insects, University of Arizona

Bugs can be annoying and sometimes pose a risk to public health.

Species of mosquitoes in Arizona are vectors of pathogens that cause western equine encephalitis, St. Louis encephalitis, and West Nile fever. West Nile Fever is caused by the mosquito-borne West Nile virus, the majority of people infected have a mild illness or no symptoms at all. In some cases the virus can cause a more serious condition called encephalitis (inflammation of the brain). The elderly are at a higher risk of suffering severe medical symptoms. Up-to-date information on West Nile in Arizona can be found at http://www.azdhs.gov/phs/oids/westnile/index.htm.

Biting Bugs (no-see-ums, black flies, horse & deer flies) can inflict a painful bite, causing irritation that can persist for days, and may become infected.

Ticks can be vector agents of serious diseases like Lyme disease (the north western corner of Arizona is classed as a low risk area, the chances of contracting Lyme in other areas in Arizona is thought to be extremely low), and Rocky Mountain spotted fever. Tick-Borne Relapsing Fever is a very rare disease in Arizona, and the disease causing spiral-shaped bacteria are transmitted by a soft tick in the genus Ornithodorus.

Chiggers are a part of the Arizona landscape and generally more prevalent during the monsoon season. Chiggers do not burrow under the skin, but their feeding can cause irritation and discomfort. Chiggers attach themselves to the skin surface, hair follicles or pores, using very short and delicate mouthparts. The bite is painless, but during feeding, they inject an irritating fluid which breaks down skin tissues, they can then feed by sucking up the liquefied tissues. Chiggers drop off rapidly on their own accord or can be washed off in a soapy bath. Itching is usually noticeable after several hours. Some people are sensitive to bites and can suffer severe swelling, itching, and fever. Symptoms can last a couple of weeks.

When properly used, personal repellents can discourage biting arthropods from landing on treated skin or clothing. Using repellent and sunscreen products at the same time is an acceptable practice. However, the use of combination products that contain both an insect repellent and a sunscreen is not recommended.

CHOOSING A BUG REPELLENT

Personal repellents are available in various forms and concentrations. Aerosol and pump-spray products are often intended for skin applications as well as for treating clothing. Liquid, cream, lotion, spray, and stick products facilitate direct application to the skin. Products with a low concentration of active ingredient may be appropriate for situations where exposure to biting arthropods is minimal. Higher concentration of active ingredients may be useful in highly infested areas. Always practice non-chemical ways to deter biting bugs—window and door screens, bed netting when camping, wearing long sleeves, and long pants.

USING PERSONAL REPELLENTS SAFELY

The Environmental Protection Agency (EPA) recommends the following precautions when using personal repellents:

- Apply repellents only to exposed skin and/or clothing (as directed on the product label). Do not use under clothing.
- Never use repellents over cuts, wounds, or irritated skin.
- Do not apply to eyes and mouth, and apply sparingly around ears. When using sprays do not spray directly onto face; spray on hands first and then apply to face.
- Do not allow children to handle the products, and do not apply to a child's hands. When using on children, apply to your own hands and then apply it to the child.
- Do not spray in enclosed areas. Avoid breathing a repellent spray, and do not apply it near food.
- Use just enough repellent to cover exposed skin and/or clothing. Heavy application and saturation is generally unnecessary; if biting bugs do not respond to a thin film of repellent, then apply more.
- After returning indoors, wash treated skin with soap and water or bathe. This is particularly important when repellents are used repeatedly in a day or on consecutive days. Also, wash treated clothing before wearing it again. If you suspect that you or your children are reacting to a repellent, discontinue use, wash treated skin, and then call your local poison control center if symptoms persist. Arizona Poison and Drug Information Center: 1-800-222-1222. If you go to a doctor, take the repellent with you. Reactions to repellents usually take the form of burning or irritated skin where the repellent has been applied.

• Get specific medical information about the active ingredients in repellents and other pesticides by calling the National Pesticide Information Center (NPIC) at 1-800-858-7378. NPIC operates from 6:30am to 4:30pm pacific time Monday through Saturday The NPIC Web site is: http://npic.orst.edu/

IMPORTANT INFORMATION ON USING REPELLENTS

• Check the container to ensure that the product bears an EPA-approved label and registration number. Never use a product that has not been approved for use by EPA!

• Read the entire label before using a repellent. Even if you have used it before, read the label again - don't trust your memory.

• Follow the use directions carefully. Use only the amount directed, at the time and under the conditions specified, and for the purpose listed. For example, if you need a tick repellent, make sure that the product label lists this use. If ticks are not listed, the product may be ineffective.

• Store repellants away from children in a locked utility cabinet.

• The use of clip-on repellent devises that use battery-powered fans to circulate repellent around the body, are not recommended.

• Outdoor foggers, candles, and coils have not been found to be effective.

• Insect Repellent Wristbands have not been found to be effective.

• Studies have demonstrated that electronic mosquito repellers are useless, and that some can even increase the number of mosquito bites people receive.

TYPES OF REPELLANTS

According to the Centers for Disease Control and Prevention (CDC) the three most common active ingredients in repellents are DEET, picaridin, and oil of lemon eucalyptus. The CDC considers DEET and picaridin to be the most effective. Between the two active ingredients, picaridin products are less problematic when used repeatedly, over an extended period of time.

EPA characterizes the active ingredients DEET and Picaridin as conventional repellents and Oil of Lemon Eucalyptus, PMD, and IR3535 as bio-repellents, which are derived from natural materials. For more information on repellent active ingredients see (http://www.epa.gov/pesticides/health/mosquitoes/ai_insectrp.htm).

CONVENTIONAL REPELLENTS

- **DEET (N,N-diethyl-m-toluamide or N,N-diethly-3-methyl-benzamide)** is the active ingredient in many personal repellent products.

If DEET gets into the eyes, it can cause irritation, pain and watery eyes. People that have left DEET products on their skin for extended periods of time have experienced irritation, redness, a rash, and swelling. Washing repellents off regularly is important.

People that have swallowed products containing DEET have experienced stomach upset, vomiting, and nausea. Very rarely, exposure to DEET has been associated with seizures in people. Most of these reactions have happened after drinking products with DEET in them or using the products in ways that do not follow label directions.

Products containing DEET are currently available to the public in a variety of liquids, lotions, sprays, and impregnated materials (e.g., wrist bands). Formulations registered for direct application to human skin contain DEET concentrations ranging from 4 to 100%. DEET is designed for direct application to human skin. Skin sensitivity to DEET can develop after repeated use. If at all possible, use an alternative repellent on a child, or products that contain lower levels (<6%) of DEET, or apply to the child's clothing and not onto their skin. Do not use DEET on infants or if you are pregnant.

The longevity of protection afforded by the repellent will vary depending upon a number of environmental factors. As a general rule the higher the temperature the shorter the protective period will be. Swimming, sweating and sun screen will also affect longevity. General guidelines are given below:

DEET impregnated wrist bands have not proven to be effective at protecting the entire body.

Amount DEET	Approx. Hours of Protection
30%	6.5
15%	5
10%	3
5%	2

Off Deep Woods
(SC Johnson)
23.8% DEET
301.5 minutes of protection time

Off Skintastic for Kids
(SC Johnson)
4.75% DEET
88.4 minutes of protection time

- **Picaridin (KBR 3023, Chemical Name: 2-(2-hydroxyethyl)-1 piperidinecarboxylic acid 1-methylpropyl ester)**

Products containing picaridin are very effective against many species of mosquitoes. Picaridin is slightly toxic by eye, dermal and oral routes, but is not a dermal sensitizer. Products are virtually odorless and have a very light feel.

Cutter Advanced
(Spectrum)
7.00% picaridin
150 minutes of protection time

BIO-REPELLANTS

• IR3535 (3-[N-Butyl-N-acetyl]-aminopropionic acid, ethyl ester)

IR3535 is a chemical repellent that has been used in Europe for over 20 years, IR3535 was approved for use in the United States in 1999. Toxicity tests show that the IR3535 is not harmful when ingested, inhaled, or used on skin, although it may cause eye irritation if it enters a person's eyes.

Skin So Soft Bug Guard
(Avon)
IR3535
22.9 minutes of protection time

• Citronella and Lavender Oil

It is recommended that personal repellents such as citronella and oil of lavender not be used on children under 2 years of age. Oil of citronella shows little or no toxicity, but may cause skin irritation.

Registered citronella oil repellents protect people against mosquito bites for 20 minutes or less. Slow release products do not provide significant added benefit. Similarly, the registered lavender oil repellent protects for half an hour or less.

Based on animal studies, citronella-based products appear to be potential dermal sensitizers. Therefore, allergic reactions may occur in some individuals.

• Oil of Lemon Eucalyptus Oil (P-menthane diol; PMD)

Products containing eucalyptus oil were the most effective biorepellents tested and lasted as long as low concentrations of DEET

Repel Lemon Eucalyptus Insect Repellent
(WPC Brands)
oil of lemon eucalyptus
94.6 minutes of protection time

Fite Bite Plant-Based Insect Repellent
(Travel Medicine)
oil of lemon eucalyptus
120.1 minutes of protection time

According to the label, oil of lemon eucalyptus products should NOT be used on CHILDREN UNDER 3 YEARS.

• Soybean Oil

Soybean oil is made from soybeans and is a common ingredient in food. When USDA researchers tested the success of a soybean oil repellent, they found that it provided protection from bites for hours, depending on the species of mosquito they studied. Evaluations of soybean oil used as a pesticide have found few hazards.

Bite Blocker for Kids
(HOMS)
soybean oil
94.6 minutes of protection time

PESTICIDE PRODUCT USED WITH PERSONAL REPELLENTS

• Permethrin

Apply on clothing only
NEVER apply directly to the skin

These products may be used alone or with skin applied repellents. Permethrin is a contact insecticide; it kills ticks, mosquitoes, or other bugs when they come into contact with treated clothing. It is used on tents, clothing and materials only. Skin contact must be avoided and deactivates **permethrin within fifteen minutes.** As a clothing, tent or sleeping bag application, permethrin is very effective at keeping ticks from attaching to you and at reducing mosquito bites. Permethrin is also an effective repellent against mosquitoes and other biting flies, and can be used in conjunction with a skin repellent. Spray applications of permethrin can remain effective up to 14 days of exposure to light or oxygen, or through two aggressive washings. By storing the treated clothing in black plastic bags between uses, the fourteen days of protection can be extended considerably. If necessary a heavier application can remain effective even longer. Bed nets can be treated with permethrin.

Only consider using a permethrin based repellent in high-risk situations, where disease vectoring is a concern.

REFERENCE

Product data has been taken from:

Fradin M.F., Day J.F. 2002. Comparative efficacy of insect repellents against mosquito bites. New England Journal of Medicine. 347(1):13-8.

Barnard, D.R. and R. Xue. 2004. Laboratory evaluation of mosquito repellents against *Aedes albopictus, Culex nigripalpus,* and *Ochlerotatus triseriatus* (Diptera: Culicidae). J. Med. Entomol. 41(4):726-730.

Carlos F. S. Andrade, C.F.S. and Isaías Cabrini, I. 2010. Electronic Mosquito Repellers Induce Increased Biting Rates in Aedes aegypti Mosquitoes. Journal of Vector Ecology 35 (1): 75-78.

INTEGRATED PEST MANAGEMENT FOR THE HOME GARDEN

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RON HAY

Integrated Pest Management (IPM) is a science-based approach to managing pests using a variety of safe, sustainable and effective tactics against common garden pests, which may include insects, weeds, diseases, birds and rodents. This publication will focus on insect pests. IPM takes advantage of a variety of approaches to pest management, often controlling pests through non-chemical means. Pesticides, when needed, are selected based on their ability to target problem pests and to minimize impact on beneficial organisms, people and the environment. Focus is on developing an overall management strategy, not just controlling one type of pest. Reduction of pest problems through proper plant selection and placement is a key principle in IPM. This means selecting proper plants for your climate zone and placing them in the most appropriate spot in the garden. For example, if a plant is labeled for shade, placing it in a shady location could lead to the prevention of pest problems.

The first step in IPM is scouting for pests. This is a simple and effective technique for detecting pest insects before they get out of hand. It is simply done by walking through your yard or garden and looking for problems. During the growing season this should be done weekly for vegetables, every one to two weeks for flowers and trees and then once a month during dormant periods. While scouting, look for signs of plant stress and damage like wilt, yellow leaves, defoliation or distortion of leaves, chewed holes or leaf edges, webbing, and dead plant material. Examine plants closely for any signs of insect pests on leaves, undersides of leaves, stems or flower buds. Traps can also be helpful in catching and identifying pest problems. These traps include pheromone traps, yellow sticky traps (Figure 1), and pitfall traps. If insects are found during scouting, the next step is identification.

The most important step in IPM is the correct identification of pests. Sometimes beneficial insects are mistaken as pests. Also, certain pest species may require distinct control measures. Most insects progress through a series of growth stages from egg to immature to adult and not all treatments are successful for all pests or life stages. Identification can be accomplished in different ways such as using Cooperative Extension publications, guide books, the internet, or taking a live or well preserved specimen to your local extension office for identification by an expert. Once the pest has been correctly identified, learn about the life cycle to determine when is the best time to control the pest. Not all insects are susceptible to control tactics through their entire lifecycle. Many are more susceptible during immature stages such as larvae or caterpillars. Once a pest is detected, treatment is an individual decision; not everyone can tolerate the same amount of injury to plants or insects in their garden. Insects may be present but not causing serious damage to the plant or harvestable portions. Educating yourself is important because many plants can often tolerate a number of pests. They might even come back stronger and prettier because small amounts of injury can stimulate plant growth.

IPM CONTROL STRATEGIES

There are four general types of approaches that can be used to prevent or control pests:

- Cultural control
- Physical control
- Biological control
- Chemical control

Cultural control measures emphasize modifying the natural environment to reduce the potential for pest problems. One example is keeping your yard sanitary by removing old plant material, infested plants, and weeds that may harbor pests. Optimizing plant health also falls into this category, including proper plant care such as adequate watering, fertilizing and pruning to reduce plant stress. One of the most effective cultural controls when planning a garden is to carefully choose varieties that are resistant to insect damage.

Physical controls are activities that physically remove or block a pest from your plants. It is best to use these controls when pest populations are low. Examples include spraying plants with water to dislodge pests, using barriers such as row covers or nets, insect traps and soil cultivation. Physical control can also be used for pests that build nests or feed in aggregation. For example, pruning out the branches containing tents made by web building caterpillars, or sawflies that feed in groups on isolated branches of a plant can reduce pest populations and damage.

Biological control is the use of beneficial insects, also called *natural enemies*, to reduce insect pest numbers. There are two different kinds of biological control: conservation biological control and augmentative biological control. *Conservation biological control* is the process of attracting and keeping natural enemies in a garden by providing them with needed resources such as nectar and pollen, alternative prey, water, and nesting sites, or refuge with favorable conditions to sustain them. *Augmentative biological control* occurs when you buy natural enemies and release them into a home garden. For example many people purchase lady beetles for this purpose. While lady beetles are great natural enemies, the adults have the habit of flying away from their intended target when released. Lady beetle larvae (Figure 2), green lace wing larvae and some mite species are better predators that will stay near the release site and prey on insect pests. Parasitic wasps such as *Aphidius* species (Figure 3) are also useful natural enemies. They lay their eggs inside aphids, where the wasp larva develops, killing the aphid and causing the body to swell (Figure 4). When the adult wasp emerges it attacks more aphids and the cycle continues. To encourage future colonization by natural enemies, it is important to avoid using insecticides that may also kill the natural enemies.

Chemical control is used in IPM but other options should be explored before turning to pesticides. Many times, using a pesticide can cause more harm than good. Many pesticides kill natural enemies along with the pest, and pest populations tend to rebound much more quickly than their natural enemies. This can lead to a "pesticide treadmill" where gardeners are trying to stay one step ahead of the pests. Understanding the pest's life cycle and knowing where the pest is living and feeding is vital for successful chemical control. Proper placement, timing, and use of effective application methods will save time and money and more effectively control the pest. It is also important to research your pesticide choices and to choose a product that is less persistent in the environment and affects only the targeted insect pest, leaving more natural enemies in place to help control pests. For help with pesticide selection, contact your local Cooperative Extension office. Treatment should not be planned according to a calendar. For example, if you suspect aphids will attack your roses in a certain month because they appeared in the same month last year, make sure they are actually there this year by scouting the area in question before deciding if a treatment is necessary.

Integrated Pest Management is an approach that considers many aspects of plant health, from planning and planting to pest identification and treatment. A range of management tools and tactics (not only pesticides) can be used to control pests while minimizing risks to plants, people, pets and the environment. Record keeping is important to record successes and failures. Information that should be recorded are, planting date, bloom time, harvest time (if applicable), pest occurrence and damage, and how pest problems were resolved. Educating yourself about insect pests and keeping current on available management strategies is vital since the specific tools of IPM continuously change with technology.

IPM REFERENCES AND PEST IDENTIFICATION

IPM in Vegetables Texas A&M University: vegipm.tamu.edu/indexbyname.html

University of California IPM Online: www.ipm.ucdavis.edu/PMG/menu.homegarden.html

IPM RESOURCES

The following companies are sources for IPM products such as pest monitoring traps and natural enemies:

Green Methods—greenmethods.com/site/

Arbico Organics—www.arbico-organics.com

Koppert Biological Systems—www.koppert.com/products/

Figure 1. Yellow sticky trap used to scout for pest insects.

Figure 2. Ladybeetle larvae attacking aphid.

Figure 3. Aphidius wasp hunting for aphids to lay eggs in.

Figure 4. Swollen aphid body after an Aphidius wasp has laid an egg in it.

Working the Bugs Out

Bed Bug Control—What Landlords and Tenants in Multi-Family Housing Need to Know in Arizona

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In 2011 Arizona joined several other states enacting bed bug related legislation. The new legislation (SB 1306) assigns specific responsibilities to landlords and tenants in multi-family housing. This law does not apply to a single family residence. Under Arizona law, landlords are required to provide existing and new tenants with educational materials on bed bugs. Additionally, landlords are prohibited from knowingly leasing a bed bug infested residence. The legislation requires tenants to notify the landlord of a bed bug infestation and disallows them from knowingly moving bed bug infested materials into a residence.

Summary of the Arizona law

- **TENANTS** are required to notify landlords in writing or electronically of the presence of bed bugs.
- **TENANTS** are prohibited from moving items into the building if they are known to be infested with bed bugs.
- **LANDLORDS** are required to provide educational materials on bed bugs to existing and new tenants.
- **LANDLORDS** are prohibited from renting homes known to have active bed bug infestations.

The Arizona bed bug legislation can be read at: http://www.azleg.gov//FormatDocument.asp?inDoc=/legtext/50leg/1r/laws/0191.htm&Session_ID=102

LANDLORDS

- Shall not enter into a lease agreement if an apartment is known to be infested with bed bugs.
- Shall provide educational materials on bed bugs, to tenants.
- Also in statute ARS 32-2325(1) and (2) to do structural pest control, a person must be licensed and certified. Thus the additional requirement that the Landlord shall utilize only licensed Pest Management Professionals to remediate infestations.

Landlords should consider having a clearly written Bed Bug Protocol included within lease agreements.

General pest management service contracts may not include bed bug remediation. It may be advisable to hire an experienced Pest Management Professional to manage properties you are responsible for and to verify there are no bed bugs in recently vacated homes. If contracting with a bed bug detection dog service provider, it is advisable to confirm that the dogs and handlers are third-party certified by World Detection Dog Organization (WDDO), National Entomology Scent Detection Canine Association (NESDCA) or similar evaluation agency.

TENANTS

- Shall not knowingly move bed bug infested items into an apartment.
- Shall provide notice to the landlord if bed bugs are suspected. Giving notice of a possible bed bug infestation may give the landlord permission to enter the home. If bed bugs are confirmed, the tenant should grant access to the premises to the Pest Management Professional involved in remediating the infestation.

If a notified landlord fails to inspect or respond, it may be necessary to mitigate a bed bug infestation. It would be advisable for the tenant to provide written notice to the landlord of the tenant's intention to remediate the infestation. The tenant may have to initiate the work to be done by a licensed Pest Management Professional, and submit to the landlord an itemized statement for the pest control services.

Before moving into an apartment, it may be advisable for tenants to hire an experienced Pest Management Professional to verify there are no bed bugs in your potential new home, as well as in your last home, including your personal belongings. This law does not create a right of action against a landlord. Tenants have to use the normal procedure of complaining and giving the landlord the opportunity to remedy the situation. Having an assessment done before moving in may limit your liability for bed bug treatment costs. Avoid moving into infested apartments.

Single Family Residence

The landlord and tenant of a single family residence may agree that the tenant is responsible for bed bug mitigation. If you are a prospective tenant, please read your lease carefully so you understand your financial obligations under the agreement. Having your new home inspected before you move in could save you a lot of money.

IMPORTANT THINGS TO KNOW ABOUT BED BUGS

Bed Bug Basics

Bed bugs are blood-feeding insects that live in beds, and the cracks and crevices of furniture, walls, flooring, etc. Adult bed bugs are about a quarter of an inch in length (about the same length as an apple seed), oval in shape, and brown or reddish-brown in color. They are usually flat unless they have just had a blood meal. Bed bugs are generally most active during the night when they move between sleeping or stationary people and harborage areas (such as cracks and crevices). They do not have wings, and do not fly or jump, but they are able to crawl quite quickly when disturbed. Bed bugs prefer to feed on humans, but can feed on pets and may be found in pet bedding in an infested home.

Bed bugs have piercing-sucking mouthparts and feed on blood. However, they are *not* known to transmit disease causing organisms.

Immature bed bugs look the same as adults, only smaller. Newly hatched bed bugs are virtually colorless, and gradually get darker as they grow. The adults mate, and females lay white eggs that resemble grains of salt that are often stuck to surfaces. They can be laid singly or in clusters.

Bed bugs can be found in very clean locations and unlike German cockroaches that are associated with unsanitary conditions. Bed bugs are expert hitch-hikers, and anyone can inadvertently acquire them. Because they are most often found in places where people sleep, they occur most commonly in homes, hotels, shelters, dorms, barracks, and long-term care facilities. While bed bug sightings can occur in all the places people go, they are usually found breeding (sometimes in high numbers) in places where people sleep or are stationary for long periods of time.

Most bed bug activity occurs after dark, but they will feed during the day if they are hungry and have a stationary host. During the day you can see the tell-tale signs that indicate their presence. A flashlight and a magnifying glass are useful tools when inspecting for bed bugs. Signs of this pest include:

Actual Bed Bugs

Look closely in the seams of mattresses, box-springs, and in the joints of furniture in and close to sleeping areas.

Bed bug excrement

Bed bug frass (poop) looks like dark spots or rusty stains on mattress fabric or bedding. Harborage areas can be indicated by spotting on walls or furniture.

Bed bug exoskeleton molts

Growing bed bugs molt, leaving their old exoskeleton behind. The molts look like transparent bed bugs.

Blood

Crushed bugs will leave a splat of blood on sheets. Using white or pale colored sheets helps verify a suspected infestation in a home.

Bed bugs have a distinct musty, sweet odor; some people are reminded of raspberries, while others are reminded of coriander. In relatively light infestations there may be no noticeable odor at all.

Bites on exposed skin after sleeping

People experience a range of reactions to the bites; some have no reaction, while others experience a reaction to the saliva injected while the insects feed. People may develop itchy, even painful welts immediately, or up to two weeks later. Repeated bites tend to generate more severe reactions, and heavy infestations of bed bugs can cause anemia in children and the elderly. Secondary infections occur due to the scratching of bites.

Avoid scratching! Over-the-counter antihistamines and topical hydrocortisone creams help reduce the irritation.

Finding bug bites does not mean you have bed bugs in your home. There are many things that cause itchy bumps and welts to form, but if you notice bites on exposed skin after sleeping, take a moment to inspect sleeping areas for the other signs.

Preventing Bed Bugs

Don't Panic! All bed bug infestations can be remediated successfully when the appropriate management steps are followed.

Do not use over-the-counter pesticides! Misuse of these products could injure your family and yourself. Certain products make infestations far worse by encouraging the movement of bugs into wall voids, making remediation more challenging and expensive.

There are ways to minimize the chances of bed bugs arriving in your home in the first place; it is highly recommended that you take the following precautions:

- Do not be tempted to move furniture or items from the curb-side or from a dumpster into your home. Even if items look perfect. It's not worth the risk!
- Do not move in second-hand furniture, especially mattress or box-spring items, unless you are absolutely certain the items come from a bed bug free location. If you cannot be 100% certain the items have never been exposed to bed bugs, don't run the risk!
- Inspect rented furniture very carefully before accepting it into your home. Avoid renting bedroom furniture if possible.
- When travelling, check motel/hotel rooms before unpacking or sleeping (at a minimum check the mattress, box-spring, and behind the headboard for any signs of bed bug activity). Even if you do not find evidence of bed bug activity, avoid placing luggage on the bed or on the floor near the bed. Upon returning home, machine-wash and dry all clothing on a high heat. Carefully check the outside and inside seams of luggage with a flashlight, looking for any movement. Store luggage in the garage or outdoor storage area.
- Reduce clutter. An uncluttered home is much easier to monitor and remediate.
- Wash bedding weekly and dry items on a high heat for an additional 40 minutes after the items are dry.
- Avoid moving bedding in and out of other locations as much as possible. If you take blankets and pillows from home to hotels, school, child care facilities, other homes, etc. wash and dry everything immediately upon returning.
- Know what is happening in your building. Bed bugs can move between homes in multifamily buildings.
- Shared articles such as vacuums, wheel chairs, etc. can harbor bed bugs. Avoid borrowing or loaning out these items if possible.
- Bed bugs are sensitive to extreme temperatures in all of their life-stages. So tossing all clothing/bedding in a hot (140°F) dryer for 40 minutes is an effective way of killing them. If you suspect you have been exposed to bed bugs, rinse and leave footwear outside to dry. Inspect bags and items entering the home. Wash and dry clothes on a high heat, leaving dry clothes in the dryer for an additional 40 minutes on a high heat. Normal showering will remove bed bugs from your person.

Managing Your Home

- Inspect for bed bugs frequently, especially when changing bedding each week. Bed bugs hide in cracks less than 1 mm wide. Initially they are found in the seams, folds, and joints of mattresses, box-springs and headboards. As they breed and the population increases they can be found in areas farther from the bed (electrical outlets, floor cracks, fire alarms, baseboards, furniture, door frames, under carpeting, behind picture frames, in drapery folds and behind loose wall paper).
- Consider placing bed bug monitoring devices such as ClimbUp ® Interceptor traps under bed legs. There are a number of bed bug traps available, and the simplest, relatively inexpensive ones work very well.
- Vacuuming is an effective way to remove bed bugs and the dirt that provides them shelter. Vacuum weekly (at a minimum) and discard bags or canister content into outdoor receptacles.
- Fit mattresses and box-springs with encasings designed to prevent the movement of bed bugs in and out of bed sections. If you can only afford one encasement, cover the box-spring, as this is the most favorable place for bed bugs. The higher quality encasements have been tested, and shown to be very effective. If an encasement tears, it should be replaced.
- Eliminate harborage opportunities by sealing cracks and crevices with a silicone-based sealant, glue down loosened wallpaper edges.
- Minimize use of cardboard boxes for storage.

If Bed Bugs Arrive No Need to Panic!

Bed bugs are a growing problem. Early detection and involvement of an experienced Pest Management Professional will help to minimize costs, uncomfortable bites, and stress.

The "Do not" list below references things that people tend to do that inadvertently make infestations spread and ultimately far more difficult to control. The "Do" list offers ways to safely manage the problem until a Pest Management Professional can control the infestation.

Do not

- Do not move items in or out of infested rooms. If you need to remove clothing, wash and dry the items before using. Essential non-washable items should be inspected carefully before removal from the area. Clock-radios and other electronic items should not be removed at all. In general, move as little as possible.

- Do not apply over the counter pesticides or use bug bombs; retail products are *not* effective against bed bugs, and generally make the problem worse. Professionals use very specialized heat, cold, and professional chemical treatments which are only available to licensed professionals.
- Do not move infested beds or furniture outside. Items have to be wrapped, marked as dangerous or bed bug infested, and discarded in a manner that avoids spreading bed bugs throughout your home or to other people's homes. Unmarked items should not be left accessible to other residents.
- Do not host visitors while you are battling bed bugs, they may return to their own home with hitchhikers that set up residence in a new location.
- Do not simply move into another home in order to get away from the bed bugs, there will be bed bugs on the articles, furniture and clothes you take with you. Additionally, bed bugs can survive for months without a blood meal and some may still be alive even after an extended absence.

If you have to vacate your home, take as little as you can with you. Launder clothing and washable items immediately. Showering will effectively remove bed bugs from your person.

Do

- Do report bed bug sightings to property managers as soon as possible. Bed bugs can multiply rapidly, and the sooner they are reported, the easier they are to control.
- Do follow the instructions given by Pest Management Professionals very carefully.
- Do wrap and mark infested items and articles in plastic bags and throw out in outdoor dumpsters.
- Do launder infested washable items and dry on a high heat for 40 extra minutes after they are dry.
- Do soak delicate fabrics in warm water and laundry soap for several hours before rinsing.
- Do cut, mark, and plastic wrap mattresses and irreparably damage furniture so other people are not tempted to move infested things into another home.
- Do vacuum frequently and immediately remove the vacuum bag or empty the canister into a plastic bag and discard in an outdoor dumpster.
- Do carefully inspect the guest room and launder towels and linens after visitors depart.

Additional Information Resources

EPA Bed Bug Information www.epa.gov/bedbugs

Guidelines for Prevention and Management of Bed Bugs in Shelters and Group Living Facilities http://www.nysipm.cornell.edu/publications/bb_guidelines/

National Pest Management Association Best Management Practices for Bed Bugs http://www.bedbugbmps.org/

National Pest Management Association International http://allthingsbedbugs.pestworld.org/

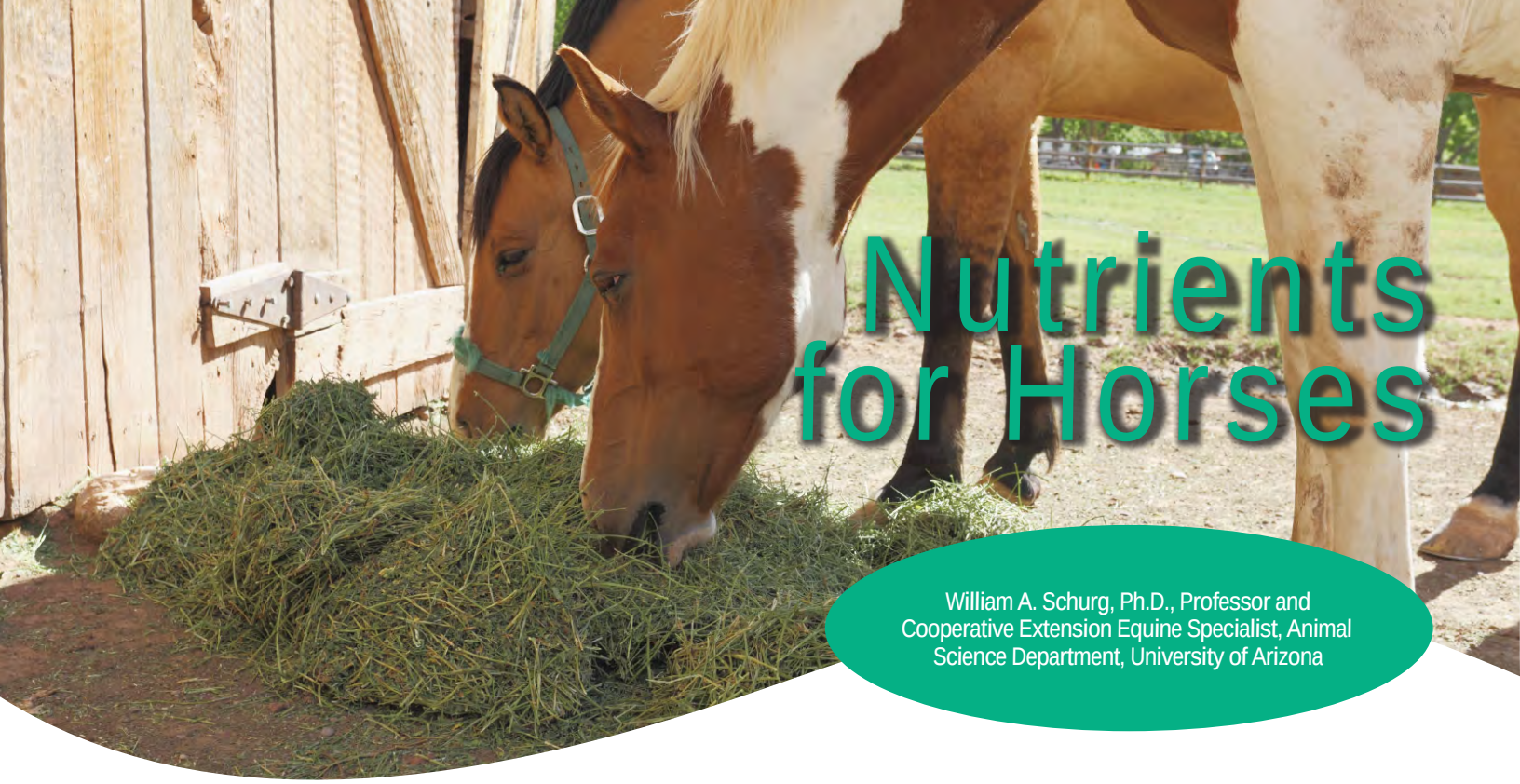
Central Ohio Bed Bug Task Force http://centralohiobedbugs.org/index.html

Bed Bug Central http://www.bedbugcentral.com/

Joint Statement on Bed Bug Control in the United States from the U.S. Centers for Disease Control and Prevention (CDC) and the U.S. Environmental Protection Agency (EPA) http://www.cdc.gov/nceh/ehs/publications/bed_bugs_cdc-epa_statement.htm

Bed bugs have been with us throughout human history, remember:

- Bed bugs can happen to anyone!
- Bed bugs are not known to transmit deadly disease organisms.
- Do not be tempted to apply retail pesticides.
- Every situation can be resolved successfully.



Nutrients for Horses

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In meeting the nutritional needs of horses one must consider the actual nutrients required rather than the feedstuffs that can be utilized. As with many animals, horses eat to meet their energy needs. Generally if we can "fill the tank" with fuel the horse can maintain itself reasonably well. Forage-eaters such as equines must consume large quantities of food that is generally low in energy/mass to be able to adequately meet their energy needs. In the process, because of the large quantities consumed, adequate protein is also consumed. Thus, the general nutrients needed by the horse are water (clean, fresh and always available); energy (carbohydrates, fats and protein); protein (quality vs. quantity); minerals (macro and micro); and vitamins (fat-soluble and water-soluble).

Water is an extremely important ingredient in any feeding program. Perhaps the most critical nutrient for our working horses is one that we tend to take for granted and overlook. For frequent and prolonged physical activity of any kind, the most important nutrient a horse needs is WATER. Under severe exertion, a horse can lose up to half of this body's total protein, and virtually all of his fat reserves, before significant problems happen, however just 15% loss of his internal water supply can be fatal. Additionally, horses like all animals cannot consume adequate dry food without having adequate water intake. At rest during a normal 70 degree temperature day, a horse can be expected to consume about 4-10 gallons of water. When temperatures rise above 80 degrees the water consumption can increase 2-3X the maintenance levels. One should attempt to keep clean, fresh water available at all times under all environmental conditions. REMEMBER: Ask yourself if you'd drink the water your horse is asked to drink. If not, get him or her some clean and fresh water!!

The horse is unique to other farm animals. The horse is produced and maintained for their athletic ability, thus horse owners must supply the horse with enough energy to meet their needs. The horse must have enough fuel not only for maintenance and development, but requires extra energy for his various activities. Energy is supplied primarily from soluble carbohydrates, starches and fat from feed grains. The end product of carbohydrate digestion in the first parts of the digestive tract is glucose, while the fibrous materials like hay are broken down by microbes in the lower digestive tract and produce volatile fatty acids to augment the energy needs of the horse. Energy is necessary for proper functioning of basal metabolism, energy storage, reproduction, growth maintenance of hair coat as well as for milk and muscle. Horse owners must first provide adequate nutritional support to supply all the energy the horse needs.

Protein must be supplied in adequate amounts for proper growth and development in horses. Protein is used as source of amino acids which function in muscle growth, skeletal development, maintenance and repair of body tissues, and hormone production. It should be pointed out that the protein in creep or young growing horse diets should be present in a larger percentage and it should have an excellent balance of essential amino acids, especially lysine, methionine and tryptophan. The amino acid threonine will be also important when the feeding program is based upon grass forage. Mature horses can be fed smaller dietary percentages with lessor regard to essential amino acids but again balanced diets are essential.

Minerals should be included in the diet in both adequate and balanced amounts. They are essential for normal development, and are involved in a number of important functions including: electrolyte balance, nerve impulse transmission, energy utilization and maintenance of soft tissues, to name a few. There are 13 minerals essential for life and under Arizona conditions, seven of these are of primary concern. They are calcium, phosphorus, iodine, copper, zinc, sodium and chlorine. During the hot summer months salt requirements are greater than any time during the year. It is important that salt is added daily to the horse's diet. We have found that many horses will not consume enough additional salt from the block form, so adding about a tablespoon of loose trace mineralized salt is recommended. Since the bulk of Arizona horse feeding comes from

alfalfa hay use, feeding supplements to assist in the balance of calcium, phosphorus, copper and zinc is essential. This balance is especially important when feeding young growing horses as skeletal development can be altered if the diet is not adequately balanced. Vitamins for the most part are not usually needed in added amounts when a normal balanced diet is fed. However, of the fat soluble vitamins it is important to make sure that the horse receives adequate levels of Vitamin A. Vitamin D is not normally a problem as long as the horse has access to daylight. In recent years the level of Vitamin E has been low in some forages in our state, so the status of this vitamin needs to be understood. Vitamin K and the water soluble vitamins C and the B complex all under normal maintenance situations should not need to be added to the diet. However, under heavy stress situations, the water soluble vitamins can provide added benefit.

Horse owners have many options when it comes to feeding techniques. Because the activity of individual horses vary tremendously (much more than with other large domestic animals). There are five major factors that regulate the kind and amount of nutrients required by an individual horse. These are: maintenance, growth, reproduction, lactation and exercise. Every animal's nutrient needs are dependent upon the type of exercise or the purpose for which he/she is being used. It is also advisable to know the approximate age, weight and body condition of your horse. The nature of the feeds available and the chemical composition of those feeds is critical to understand in order to effectively feed a balanced diet that will meet the nutrient needs. One must remember that every horse cannot be fed in a similar fashion. Young growing horses will have very different requirements than an older, mature animal or a lactating mare.

Horse owners with sound information regarding digestive physiology, nutrients and requirements, various classes and unique feeding management practices and many of the common feeds and their compositions should be well equipped to evaluate nutritional practices.


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