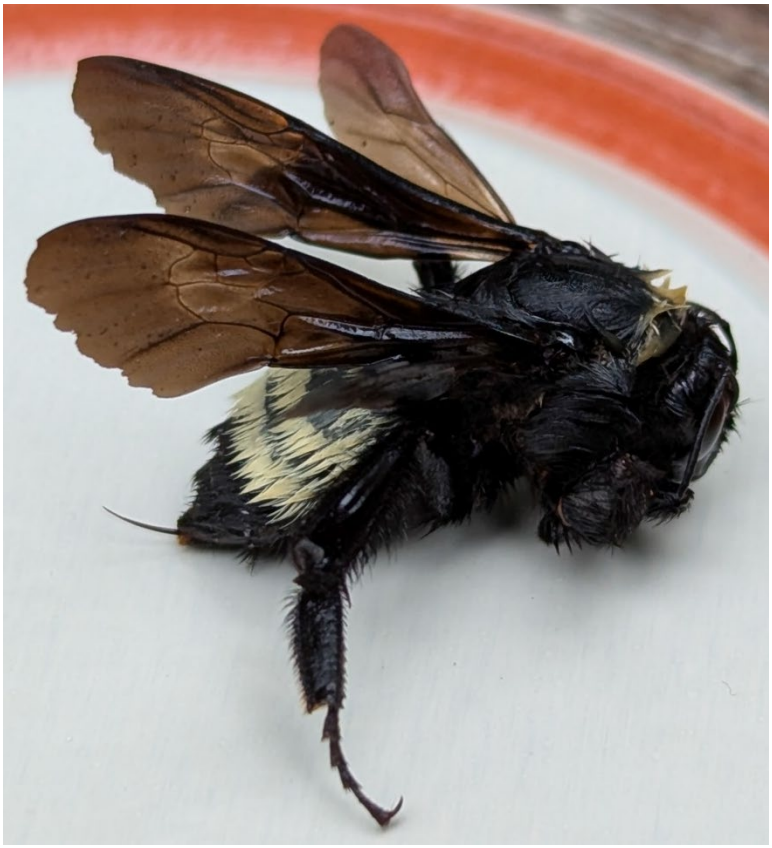


American Bumble Bee

Note from the Wildland Fire Lessons Learned Center:
While this incident did not occur in a wildland fire environment, its story and lessons are applicable to wildland firefighters who operate in similar field conditions and often encounter bees.

Contents

Executive Summary

On Aug. 20, 2024, a Shawnee National Forest employee, Austin Davidson died after being stung by bees. Working in a lowland management area, Austin and a coworker were clearing brush utilizing weed trimmers. Austin came upon a concealed ground nest, the bees were disturbed, and an attack response was provoked. The bees stung multiple times delivering a large amount of bee venom that led to an unrecognized medical emergency that resulted in death roughly five hours after the incident.

Background

Shawnee National Forest

The Shawnee National Forest includes over 289,000 acres of National Forest System land in Illinois and is comprised of a supervisor's office and two ranger districts. The forest sits at the confluence of the Mississippi and Ohio rivers. The forest has seven wilderness areas, four national natural landmarks, four heritage resource sites on the National Register of Historic Places, two national scenic byways, 80 designated natural areas: 10 are designated as research natural areas, 56 ecological areas, 14 botanical areas, three geological areas, and seven zoological areas.

Oakwood Bottoms Greentree Reservoir

Oakwood Bottoms Greentree Reservoir is a 4,700-acre bottomland-forest ecosystem in the Mississippi River floodplain on the Mississippi Bluffs Ranger District. The area is flooded habitat for migratory and over-wintering waterfowl, and other game and non-game species, including songbirds, raptors, reptiles, amphibians and other native, wetland species. The area contains stands of pin oak and other bottomland hardwood trees and associated understory. A variety of mast-producing oak species make up 60% or more of the forest. A system of levees divides the area into compartments that are annually flooded. Water depth is somewhat variable and managed, ranging from two to 18 inches of water to provide wetland habitat. The land supports high populations of ducks and other waterfowl as well as other game and non-game species. A variety of recreational opportunities is provided in a primarily non-motorized setting, including hunting, hiking, and wildlife-viewing. Roads provide non-motorized access for forest management and limited recreational use.

Note to Reader

This report presents a narrative, derived from interviews, of the events leading up to the death of Austin Davidson. Other than the deceased, the other names in the report have been changed to protect their privacy. The purpose is to place you in the employees' shoes with the information they had at the time, and to prompt you to view the situation as they did. **In fact, this accident could have occurred on any forest, to any field-going employee.** The lesson learned analysis section focuses on conditions that were present even though they did not cause the accident. The conditions identified offer learning opportunities for our employees to consider. Studies have shown focusing on learning can improve our organizational culture. As readers experience this accident, please take the opportunity to explore these questions:

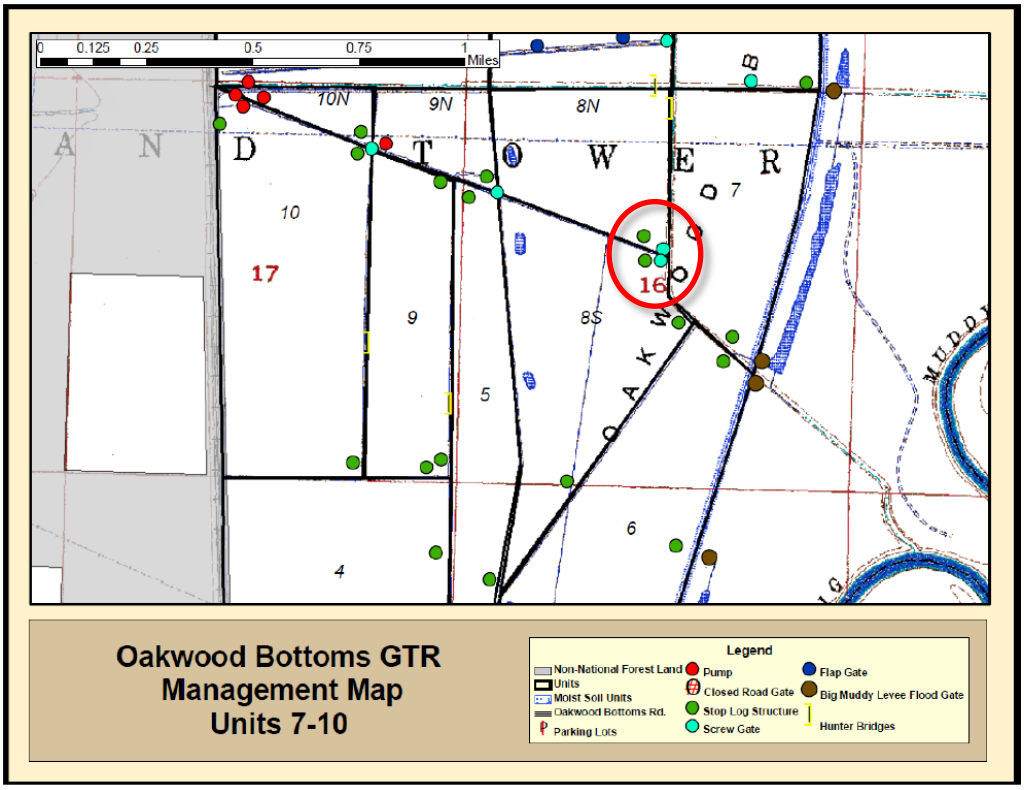
- Can you understand how the actions of individuals made sense at the time?

- Even if you truly feel you would act differently under similar circumstances, what is different about your own workplace conditions that others could learn from?
    - How did those come to be? How can you share that information?
- What needs to change in the broader culture before all would respond in a way you believe they should?
- What messages do leaders need to reinforce with their own people right now?

Narrative

On Austin's first day back to work after paternity leave, he was asked to join Tony clearing brush at Oakwood Bottoms Greentree Reservoir the following day. Austin was in his permanent position as a district partnership coordinator and his supervisor approved the work activities. The location was well known to Austin as he recently detailed into the wildlife biologist position that specifically oversaw the Oakwood Bottoms Greentree Reservoir. Austin participated in many projects at the site, and he was an avid hunter who frequented the reservoir.

On Aug. 20, 2024, Tony, forestry technician (multidisciplinary technician), arrived at Mississippi Bluffs Ranger District a little before 6 a.m. An hour after Tony's arrival, Austin arrived at the district office. Both employees gathered their gear and departed for Oakwood Bottoms Greentree Reservoir. Pulling onto Centerline Road at roughly 8 a.m. and entering the management area, Tony and Austin were confronted with a couple downed trees blocking the road. The two made quick work of clearing the road and continued to the worksite, Oakwood Bottoms Fill Ditch Unit 8.



The day's work activities focused on removing brush (grass and small diameter brush) adjacent to Greentree Reservoir system infrastructure (fill/transfer ditch, stop log structure, and screw gates). The removal of brush facilitated large equipment mowing activities prior to seasonal

flooding of various units. Additionally, flooding activities are actively managed and require unobstructed access to infrastructure to adjust water levels throughout the flooding season as described in the management plan.

Figure 1: Screw Gate

Figure 2: Stop Log Structure

Departing Centerline Road and traveling east, the two entered Unit 8 via the north side of a fill/transfer ditch that split Unit 8 into two sections, Unit 8 North and Unit 8 South. When the two arrived at their worksite, they looped around the two screw gates and parked the vehicle 60 feet from the gates on the south side of the fill/transfer ditch now facing west. The employees donned their Personal Protective Equipment (PPE) prior to beginning work.

PPE: *Hard Hat, Long Sleeves, Long Pants, Safety Glasses, Hearing Protection, Gloves, and Boots.*

Figure 3: North screw gate & nest adjacent to weed trimer.

Figure 4: Hard hat location.

The two conducted a final check of their Stihl weed trimer and proceeded to their respective work areas. Tony entered the fill/transfer ditch near the stop log structure and Austin went to the screw gates to begin working, they were within 40 feet from one another. Shortly after starting, Tony caught Austin out of the corner of his eye running from his immediate work area adjacent to the north screw gate. Austin dropped his weed trimer, rapidly removed his PPE, and lost his wedding ring attempting to evade what he quickly learned were stinging insects attacking him.

The following day, it was unofficially determined that the American Bumble Bee was the stinging insect that attacked Austin. Multiple sources confirmed and validated the results after further evaluation and use of research equipment.

Unsuccessful in evading the stinging insects, Austin fell to the ground a couple of times as Tony yelled for him to get into the truck. Once in the truck, Tony quickly rolled up the windows to block the stinging insects from getting to Austin. With the truck secured, Tony began pulling bees from Austin with his bare hands. Tony was not attacked, and the bees remained fixated on Austin as Tony pulled the bees from him.

Bee stings deliver an alarm pheromone when there is a perceived threat and Austin was identified as the treat to the bee colony. Tony was not stung because he did not have the pheromone on him.

After processing the events, the two decided to leave the worksite, gear and ring were left in the field. Austin did attempt to persuade Tony to return, so he could retrieve his gear and look for his wedding ring. Tony did not agree, and he drove them away from the project area. While on the public roadway, Tony insisted Austin visit a nearby hospital to be evaluated. Austin shared he was fine and just wanted to return to the district office. Austin did not present any unique signs or symptoms.

Tony and Austin have worked together in the past and both have experienced insect stings before. Austin did not react differently than what was observed previously.

When the two returned to the office at roughly 10 a.m., Austin was assessed. A few coworkers counted approximately 50 bee stings. The bee stings resembled small puffy mosquito bites, purple in color, and with a small defined puncture wound in the center (stinger's point of entry). Austin did not present any unique signs or symptoms during this assessment.

Austin, with the assistance of Tony completed the eSafety report, self-reporting as a precautionary report with no medical attention expected. At roughly 11:30 a.m., Austin phoned his supervisor and shared that an eSafety Report was being sent and required his coordination. The two discussed the precautionary report and what Austin would do the remainder of the day. Austin elected to telework as his field day was interrupted and that he would be with his wife who was at home. Before Austin left to telework, he had lunch with Tony at the district office. Austin did not present any unique signs or symptoms prior to leaving the office.

At 2:33 p.m., Austin's supervisor informed the district ranger that Austin's wife called him, Austin was unconscious, she could not wake him, and an ambulance was taking him to the hospital. At 3:15 p.m., it was communicated to the district ranger from multiple sources that Austin had passed away.

Tribute

Austin Trey Davidson Obituary - Visitation & Funeral Information (baileyfh.com)

Austin worked his dream career as a USDA Forest Service employee for seven years, seven months, and 17 days. His primary position was district partnership coordinator at the Mississippi Bluffs Ranger District, and he most recently completed a wildlife biologist detail specifically dedicated to Oakwood Bottoms Recreational Area. During that time, he earned several Forest

Service qualifications: Red Card qualifications, Incident Commander Type 5 Trainee, Engine Boss Trainee, Firing Boss Trainee, and Intermediate Faller (FAL2). Additional qualifications included a USDA certified pesticide applicator. He was also a proud member of the fire crew, aiding with prescribed burns and wildland fires across the country. Austin had a deep love for the outdoors and was passionate about the Shawnee National Forest in Southern Illinois. He was extremely proud of the work he accomplished on the Shawnee and Ozark-St. Francis National Forest, especially his recent work in Oakwood Bottoms Recreational Area and a project in partnership with the Stinson Memorial Library. Austin was an avid conservationist and hunter. He especially loved hunting waterfowl and turkey. He was an excellent duck and goose caller and enjoyed guiding hunts for Just Lucky Outfitters.

Lessons Learned Analysis

The Learning Review team concluded that the sequence of events – in a specific manner – resulted in a fatal accident, and slight differences in any factors could have had drastically different results. Employees across the agency face similar factors during routine field work. Implementation of forest management plans require supervisors and employees to assess risk to engage in field work. Remaining grounded in project planning, risk assessment, training, and communication will continue to aid the agency in providing a safe and healthful work environment.

On the day of the accident, after the implementation of safety mitigation measures and using required PPE, the unit reasoned the risks of engaging to be acceptable. Management and employees made the same basic risk decisions on clearing vegetation at the project area as they do routinely on other land management activities.

After considerable review of the incident, including the management, qualifications, vegetation, and local policies, the Learning Review team concluded that management and employees all performed within the scope of their duties and no reckless actions or violations of policy or protocol were found.

Unfortunately, the measures taken toward hazard mitigation did not prevent a fatal accident. Field-going employees will always face a level of risk that cannot be fully eliminated.

Below is a summary of conditions that the Learning Review team identified during the Oakwood Bottom work. We address these conditions so other employees and organizations at all levels, through honest inquiry, can be thoughtful about their own actions and behaviors and act accordingly.

Unit Working Conditions

After interviewing employees, the review team found a workforce practicing open communication and a healthy culture. Support between staff areas was present, as demonstrated by Austin’s willingness and ability to help another staff area with field work on the day of the accident.

Risk Management

The unit annually completed risk assessments that were circulated with employees to review and sign. Risk factors identified in risk assessments and their associated mitigations were acceptable

for the project work and served as seasonal training aids. Additionally, the risk factors and mitigations aligned with agency policy.

Policy

Current Agency policy for stinging insects, FSH 6709.11, 53.6 focuses on honeybees and africanized honeybees and provides different first aid responses based on stings from those two bees. The bee in this incident was unofficially identified the following day and identification was confirmed over a three-week period by three different entomologists and required evaluation under a microscope. It is unreasonable to assume a bee or wasp will be identified correctly by an employee in the field.

The Agency policy for First Aid, FSH 6709.11, 21.2 requires employees to be certified by a nationally recognized organization or the Forest Service Field Work Lifesaver Course. The first aid instruction teaches participants to identify an event, in this case insect bites and stings and evaluate the individual signs and symptoms. The identification of the bee or wasp is not considered in determining the correct treatment for the victim.

Considering the challenge with identifying a bee or wasp correctly in the field and the focus on determining the correct treatment based on signs and symptoms, the Review Team believes there is an opportunity to streamline the Agency policy for stinging insects. Policy that provides a common response regardless of the species of stinging insects would better suit field-going employees.

Bee Behavior

Environmental Conditions

Each spring, a queen bumble bee will scout out a new nest. There are many factors that aid the queen in determining the best nesting location, but two items are consistent: the location will be unoccupied, and it will be concealed. In this incident, the nesting location was an abandoned rodent hole covered in grass near what would be considered a pollinator field.

Weather Conditions

A combination of temperature, wind, precipitation, sun, and wind exposure dictates when bees will take flight. On the day of the incident, most of the bees were likely in the nest as the region experienced colder weather. The three days prior to the incident, the air temperature was 75 degrees at 8:35 a.m. and 77 degrees at 8:55 a.m. On the day of the incident, the air temperature was 66 degrees at 8:35 a.m. and 67 degrees at 8:55 a.m. This colder air temperature likely delayed flight allowing for more body heat in the nest. The need for the heat was protection of the bee brood, which is more sensitive to temperature fluctuations. The bees remained in the nest longer during the colder temperatures to keep the brood warm. This warmth also aided in a quicker response and afforded the colony more protection when the nest was disturbed. It should be noted, bumble bees have special adaptations that allow them to be active in colder weather conditions, if needed.

> ***Bee brood*** *refers to the eggs, larvae, and pupae of bees. It represents the life cycle from egg to adult within a beehive. The stages of bee brood include:*
>
> ***Egg:*** *Laid by the queen bee.*
>
> ***Larvae:*** *The growing stage.*
>
> ***Pupa:*** *The stage before the bee emerges as an adult.*

Nest Conditions

The colony of bees is built on the protection of the queen and future offspring. At the time of the incident the nest was full of bee brood (eggs) and the colony provided warmth and protection from predators. The continuation of the bee colony rests on protecting the queen and bee brood, and the bees did so when significantly disturbed by loud noise or vibration.

Bee Stinging Response

When do bees sting and how do they organize their collective defense behavior against predators? Often, when bumble bees first detect a perceived threat by loud noise or vibration, they will buzz loudly as a warning to deter a would-be predator or nest invader. When that doesn't work and a bee colony is perceiving an attack by a predator or seriously disturbed by a human who—accidentally or intentionally—gets too close to the hive, the bees launch a coordinated counterattack to defend the colony and scare off the trespasser. An important stimulus for them to start chasing and stinging the intruder is the presence of an alarm pheromone, which the bees carry on their stinger. In the event of an attack, the pheromone is dispersed either actively—by guard bees—or automatically upon stinging—by recruited soldiers. Thus, it carries information not only about the presence of an attacker, but also about the extent of the colony's counterattack. "The more bees that have stung the intruder, the more alarm pheromone has been released with each sting and the higher its local concentration," clarifies Dr. Morgane Nouvian, a biologist from University of Konstanz and joint-lead author of the study together with Andrea López-Incera from Innsbruck.

When do bees sting and how do they organize their collective defense behavior against predators? An interdisciplinary team of researchers from the Universities of Constance and Innsbruck have provided insights into these questions. More information on the research:

Andrea López-Incera et al, Honeybee communication during collective defense is shaped by predation, BMC Biology (2021). DOI: 10.1186/s12915-021-01028-x

Journal information: BMC Biology

In addition, bumble bees are large bees and therefore have relatively large venom sacs. Likewise, they are armed with needle-like stingers without barbs that allow one bee to deliver multiple jabs of venom without harming the bee.

Emergency Response and Medical

Response Conditions

Acting in an emergency, Tony advised Austin to enter the vehicle and Tony secured the vehicle by closing all the windows and pulling the bees off Austin. Collectively, after conversation they decided to leave their gear at the site and leave the work area. They discussed medical care and Austin declined. They returned to the office and conducted a better health assessment. Acting normal, Austin presented himself in a reasonable manner and completed his eSafety entry and had lunch with coworkers.

Medical Bee Stings are Venom (Toxins)

Medical literature has identified that between 5% to 7% of United States population are allergic to bees, which results in near immediate anaphylaxis response in the body. As a society, we are taught to stay away from bees because of this danger – until one day we get stung. When that happens, we experience localized pain that is not fun, but most folks learn they are initially not allergic to a bee sting.

Although we know we are not allergic, it is important to recognize that each bee sting delivers a venom/toxin into our body. Each successive sting in the same timeframe delivers more venom/toxin that is additive to its effects on the body. These effects can be minimal, leaving someone to be in discomfort, to noticeable (i.e., swelling of the arm cutting off blood supply to the hand or vomiting), to undetectable until it is too late (i.e., impact on brain conductivity ending in seizures or blood clots forming ending in a stroke or heart attack). How much venom/toxin is needed to result in symptoms, or an adverse outcome is unique to each individual.

Medical Examination

Forensic Pathologist opinion, "Acute coronary thrombosis due to multiple insect stings. History of being found down hours after multiple insect stings. No evidence of anaphylaxis response."

Austin was a physically fit, fully qualified ready reserve fire fighter, active in outdoor activities.

Acute coronary thrombosis is a term that describes a range of conditions related to sudden, reduced blood flow to the heart. These conditions include a heart attack and unstable angina.

Anaphylaxis is a severe, life-threatening allergic reaction. It can happen seconds or minutes after you've been exposed to something you're allergic to.

Recommendation

Review and update the Forest Service's policy on insect stings and bites to reflect contemporary guidance more accurately from medical practitioners, entomologist, and safety professionals. See Policy section of this report for more information.

Conclusion

This tragedy resulted from the chance alignment of certain conditions. Execution of normal work, which required the employees to be present in forested wetland habitat to clear material away from infrastructure. When the employee came upon a concealed ground nest, the bees were disturbed, and an attack response was provoked. The bees stung multiple times delivering a large amount of bee venom that led to an unrecognized medical emergency.