THE UNIVERSITY OF ARIZONA
Cooperative Extension

az2159 September 2025

Plague

Courtney Duchardt and Dawn Gouge

Summary

You might assume that the plague has not been an issue since the Middle Ages, but the bacteria that causes the disease still circulates in rodents common in Arizona wildlands. Occasionally it makes its presence known. Most human cases of plague result from the bite of an infected flea. The disease is fully treatable with antibiotics, and although human cases are rare, there are a few precautions you can take to minimize risk. These include reducing your exposure to rodents (and that of your pets); wearing gloves, protective clothing, and insect repellent when handling wild animals; maintaining pets on flea and tick treatments; preventing pets from roaming free in areas where outbreaks are reported and seeking veterinary care if they become ill; and avoiding contact with dead or sick animals.

What is plague, and how did it get here?

The bacterium that is responsible for plague is called *Yersinia pestis*. The bacterium is usually spread through the bite of infected fleas (Figure 1). When outbreaks occur in wildlife populations, this is called *sylvatic plague*; when it transfers to humans, we call it a *spillover event*, causing *bubonic plague*. Fleas biting humans to take a blood meal introduce the bacterium into the body. Bacteria travel through the lymph system to the nearest lymph node where it replicates causing swollen, inflamed, and painful lumps known as 'bubos' causing the illness known as bubonic plague. If the bacterium is spread throughout the body in the bloodstream, the symptoms of "septicemic" plague (infection of the bloodstream) rapidly develop. The

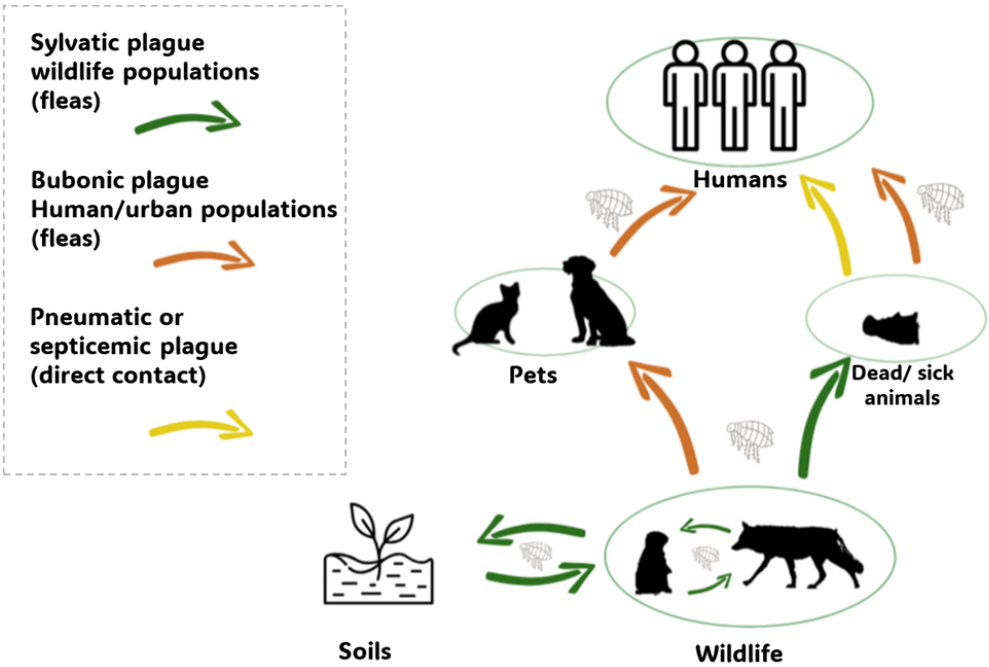

Figure 1. Transmission pathways of plague from wildland systems to humans. Arrow color indicates the type of plague, with direct contact (yellow) associated with pneumatic (infection of the lungs) or septicemic (infection of the blood) plague, while sylvatic and bubonic plague are transmitted primarily through fleas. Plague is endemic in many wildland ecosystems, but outbreaks occur among some wildlife species and can be influenced by host species traits and weather.

disease can advance to impact lung function ("pneumonic" plague) and both septicemic and pneumonic plague are life-threatening.

In very rare instances pneumonic plague can develop rapidly if a person is infected by breathing in respiratory droplets from an infected animal (Gage et al., 2000; Mead, 2015). Human to human transmission of plague is rare (Gage et al., 2000). In addition to flea bites, humans can be infected through contact with the bodily fluids and tissues of infected animals, through bites and scratches of infected animals, the inhalation of respiratory droplets from certain animals with plague pneumonia (Gage et al., 2000), or ingestion of raw or undercooked meat from an infected animal (Mead, 2015).

There is evidence that under certain soil conditions the plague bacterium can persist (Karimi, 1963), but animals involved in the sylvatic cycle primarily maintain the pathogen in our environment. In the western United States (U.S.), key reservoir hosts include ground squirrels (*Spermophilus* spp.), prairie dogs (*Cynomus* spp.), and some chipmunks (*Tamias* spp.). Unfortunately, the endangered black-footed ferret (*Mustela nigripes*) is highly susceptible to plague (Rocke, 2008) and is also dependent upon prairie dogs as prey to survive. Many other mammals, including feral and free-roaming cats and dogs are also susceptible (Gage, 1998). However, there is little evidence of plague affecting livestock (House, 2023).

Plague is not native to the U.S. but was introduced inadvertently at the turn of the 20th century, most likely because of flea infested stowaway rats on ships.

In the 21st century, human cases of plague in the U.S. are rare, occurring sporadically but consistently. Human infections are often caused after pet cats and dogs either acquire an infection themselves while roaming outside, or pick up infected fleas, and bring them home, where they may then feed on the human occupants (Campbell et al., 2019; Gould et al., 2008). This typically leads to bubonic plague, with an average of approximately 7.7 cases (clustered in several states in the southwest) occurring per year (Carlson et al., 2021, Figure 2). As a comparison, around 10 cases of rabies are reported per year (Centers for Disease Control and Prevention (CDC) - Clinical Overview of Rabies), 2000 cases of West Nile virus per year (transmitted by mosquitoes; CDC - West Nile Virus Historic Data) and 89,000 cases of Lyme disease (transmitted by ticks; CDC - Lyme Disease Surveillance and Data) were reported in 2023.

However, a number of our native wildlife species in the U.S. are particularly susceptible (Figure 3), in part, because they have only been exposed to the disease for a few decades (Busch et al., 2013). Prairie dogs are highly susceptible, both because they are rodents and because they live in high-density colonies where the disease can be more easily spread through social contact and flea transmission. This can result in 95% colony die-off. However, there is some evidence that populations of prairie dogs are beginning to develop some level of immunity to the disease (Busch et al., 2013). Prairie dogs are ecosystem engineers that provide habitat and food for many other wildlife species, including the endangered black-footed ferret, so scientists have been exploring different methods to reduce flea levels and to vaccinate these species to the bacterium itself (Bron et al., 2018).

Reducing potential exposure

Although human cases are rare, there are some practical steps that the public can take to reduce their risk of exposure to plague. Because the disease is largely spread by fleas, minimizing the chance that household pets encounter wild animals goes a long way towards reducing potential exposure. Cats are particularly susceptible and often actively hunt small rodents like mice and voles that

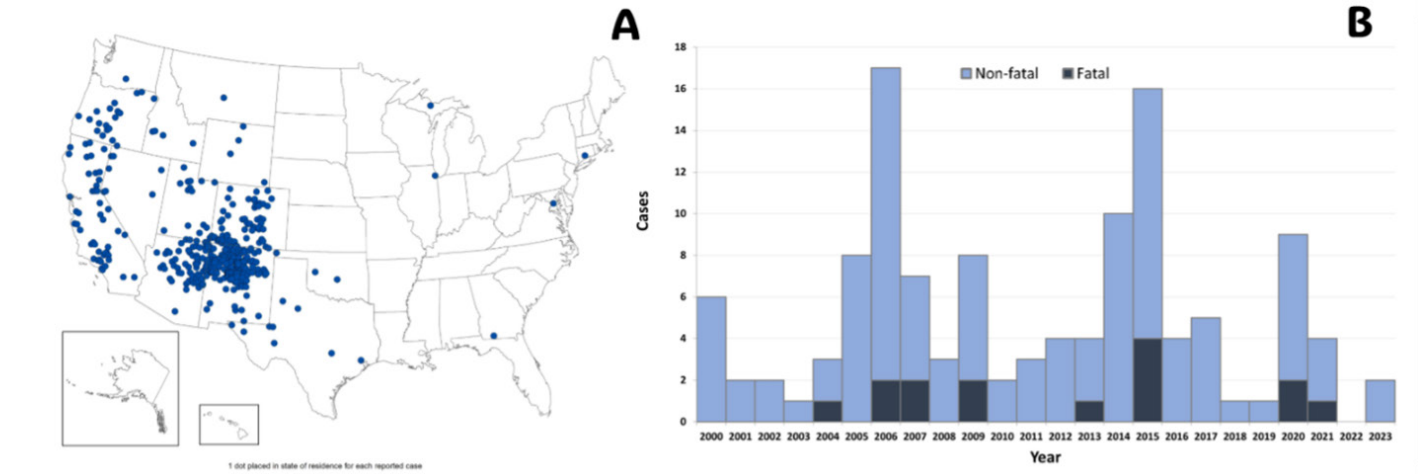

Figure 2. (A) Spatial distribution of plague cases in humans during 1970 – 2023, and (B) number of plague cases (fatal - dark blue, versus non-fatal - light blue) 2000 – 2023. From the Center for Disease Control https://www.cdc.gov/plague/maps-statistics/index.html.

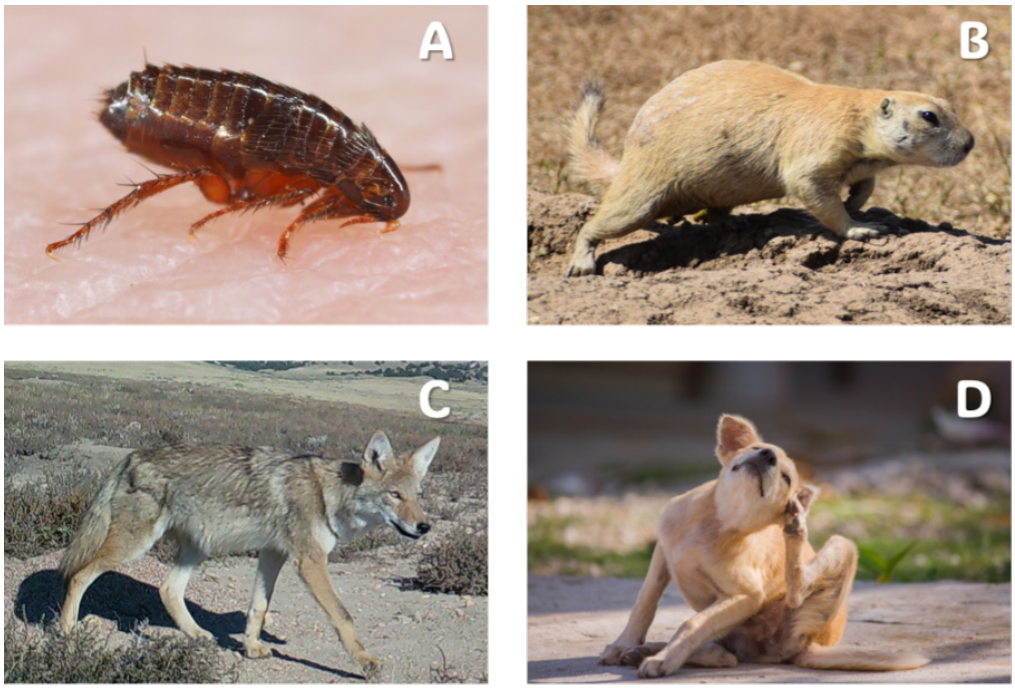

Figure 3. (A) Most plague cases are transmitted through fleas. (B) Direct contact with sick or dead animals can lead to pneumonic or septicemic plague. Plague persists in soil and in wildlife populations and especially rodents like prairie dogs, which may experience >95% colony die-off during a plague event. (C) Other wildlife species like canids (e.g., coyotes) may show fewer clinical signs of the disease when infected but still move infections throughout the landscape. (D) Pets can be exposed to the disease through carcasses or flea bites, so keeping pets on-leash and restricting free-roaming in areas with plague can substantially reduce the threat of exposure. Image credit: A & D, Adobe Stock images; B & C, Courtney Duchardt.

may carry the disease. Keeping cats indoors reduces the risk of them contracting plague, as well as other diseases.

Dogs may also contract plague infections (Runfola et al., 2015; Figure 3), and there is evidence that both domestic dogs and wild canids (e.g., coyotes; *Canis latrans*) may carry the bacterium without showing signs of the disease (Baeten et al. 2013), although sometimes they do develop symptoms. Furthermore, there are very rare cases evidencing spread of pneumatic plague after humans contact deceased dogs carrying the disease (Wang et al. 2011).

There are a number of susceptible rodent species in Arizona, including the Gunnison's prairie dog in the northern part of the state as well as a small population of imperiled Black-tailed prairie dogs in the southeast. Humans are extremely unlikely to come into direct contact with fleas on prairie dog colonies and can safely observe this extremely charismatic species from a distance but keeping pet dogs on a leash and ensuring they do not interact directly with prairie dogs or their burrows can ensure they do not contract fleas from the colonies. Avoid sharing a bed or bedroom with free-roaming pets to further mitigate risk of flea-borne transmission (Gould et al., 2008).

It is also very important to avoid interacting with dead or sick wild animals. In addition to plague, diseases like tularemia can be contracted through contact with infected animals, and several other diseases may be spread by ticks, fleas, or other parasites that transfer onto humans. If you find a sick or dead animal, reach out to Arizona Game and Fish Dispatch or your local Game and Fish Office who will assess the situation and possibly collect the animal for testing (https://www.azgfd.com/). Also ensure that pets cannot come in contact with the dead animal.

If you begin to exhibit symptoms of illness following a potential exposure (e.g., fever, chills, headache, or weakness), you should immediately seek medical treatment and inform your doctor of your possible exposure. Although there were enormous plague pandemics in Eurasia (Europe and Asia) from 500 through the late 1800s (Perry and Fetherston, 1997), it is now easily treatable with the use of modern antibiotics (Boulanger et al. 2004).

References

Baeten LA, Pappert R, Young J, Schriefer ME, Gidlewski T, Kohler D, Bowen RA. 2013. Immunological and clinical response of coyotes (*Canis latrans*) to experimental inoculation with *Yersinia pestis*. J Wildl Dis. 49(4):932-9. doi: 10.7589/2013-02-040. PMID: 24502720.

Boulanger LL, Ettestad P, Fogarty JD, et al. 2004. Gentamicin and tetracyclines for the treatment of human plague: review of 75 cases in New Mexico, 1985-1999. Clinical Infectious Diseases 38:663-669.

Bron GM, Richgels KLD, Samuel, MD, et al. 2018. Impact of Sylvatic Plague Vaccine on Non-target Small Rodents in Grassland Ecosytems. EcoHealth 15, 555–565. https://doi.org/10.1007/s10393-018-1334-5.

Busch JD, Van Andel R, Stone NE, Cobble KR, et al. 2013. The innate immune response may be important for surviving plague in wild Gunnison's prairie dogs. Journal of Wildlife Diseases 49 (4): 920–31.

Campbell SB, Nelson CA, Hinckley, AF & Kugeler KJ. 2019. Animal exposure and human plague, United States, 1970–2017. Emerging Infectious Diseases, 25, 2270. https://doi.org/10.3201/eid2512.191081.

Carlson CJ, Bevins SN, Schmid BV. 2021. Plague risk in the western United States over seven decades of environmental change. Glob Chang Biol. 2022 Feb;28(3):753-769. doi: 10.1111/gcb.15966.

Centers for Disease Control and Prevention. National Center for Health Statistics. Plague – Maps and Statistics. https://www.cdc.gov/plague/maps-statistics/index.html. Last accessed August 5, 2025

Centers for Disease Control and Prevention. West Nile Virus Historic Data (1999-2024). https://www.cdc.gov/west-nile-virus/data-maps/historic-data.html. Last accessed August 5, 2025

Centers for Disease Control and Prevention. Lyme Disease Surveillance and Data. https://www.cdc.gov/lyme/data-research/facts-stats/index.html. Last accessed August 5, 2025

Centers for Disease Control and Prevention. Clinical Overview of Rabies. https://www.cdc.gov/rabies/hcp/clinical-overview/index.html#:~:text=Thanks%20to%20rabies%20control%20programs,following%20an%20exposure%20each%20year. Last accessed August 5, 2025.

Food and Drug Administration News Release: FDA approves new antibacterial treatment for plague: http://www.fda.gov/NewsEvents/Newsroom/PressAnnouncements/ucm302220.htm. Last accessed Aug 5, 2025

Gage KL. 1998. Plague. In Topley and Wilson's Microbiology and Microbial Infections 9th ed. W. J. Hausler and M. Sussman, eds.885-903.

Gage KL, Dennis DT, Orloski KA, et al. 2000. Cases of cat-associated human plague in the western United States, 1977-1998. Clinical Infectious Diseases. 30:893-900.

Gould HL, Pape J, Ettestad P, Griffith KS, Mead PS. 2008. Dog-associated risk factors for human plague. Zoonoses and public health. Oct;55(8-10):448-54.

House JA. 2023. "Plague in Animals." from https://www.merckvetmanual.com/infectious-diseases/plague/plague-in-animals.

Karimi Y. 1963. Natural Preservation of Plague in Soil. Bull Soc Pathol Exot Filiales 56: 1183–1186.

Mead, PS. 2015 *Yersinia* Species (Including Plague). In. Mandell, Douglas, and Bennett's Principles and Practice of Infectious Diseases (Eighth Edition), Editors: John E. Bennett, Raphael Dolin, Martin J. Blaser, W.B. Saunders. Pages 2607-2618.e2, ISBN 9781455748013, https://doi.org/10.1016/B978-1-4557-4801-3.00231-9.

Plague Manual: Epidemiology, Distribution, Surveillance and Control. 1999. World Health Organization, Geneva.

Perry RD, Fetherston JD. 1997. *Yersinia pestis*—etiologic agent of plague. Clin Microbiol Rev. 10:35-66.

Rocke, TE, 2008. Protecting Black-Footed Ferrets and Prairie Dogs against sylvatic plague (No. 2008-3087). US Geological Survey.

Runfola JK, House J, Miller L, Colton L, Hite D, Hawley A, Mead P, Schriefer M, Petersen J, Casaceli C, Erlandson KM, Foster C, Pabilonia KL, Mason G, Douglas JM Jr 2014. 2015. Centers for Disease Control and Prevention (CDC). Outbreak of Human Pneumonic Plague with Dog-to-Human and Possible Human-to-Human Transmission--Colorado, MMWR Morb Mortal Wkly Rep. 2015 May 1;64(16):429-34. PMID: 25928467; PMCID: PMC4584809.

Wang H, Cui Y, Wang Z, Wang X, Guo Z, Yan Y, Li C, Cui B, Xiao X, Yang Y, Qi Z, Wang G, Wei B, Yu S, He D, Chen H, Chen G, Song Y, Yang R. 2011. A dog-associated primary pneumonic plague in Qinghai Province, China. Clin Infect Dis. 52(2):185-90. doi: 10.1093/cid/ciq107. PMID: 21288842.

THE UNIVERSITY OF ARIZONA
Cooperative Extension

AUTHORS

Courtney Duchardt
Assistant Professor, Rangeland Wildlife, School of Natural Resources & Environment

Dawn Gouge
Medical Entomology Professor & Integrated Pest Management Specialist - Department of Entomology

CONTACT

Courtney Duchardt
cduchardt@arizona.edu

This information has been reviewed by University faculty.
extension.arizona.edu/pubs/az2159-2025.pdf

Other educational materials from Arizona Cooperative Extension can be found at:
extension.arizona.edu/pubs