

White-Nose Syndrome

Pseudogymnoascus destructans

About

White-nose syndrome (WNS) is a fungal disease of bats caused by a white-coloured fungus called *Pseudogymnoascus destructans* (often referred to as simply *Pd*). The fungus appears on the muzzles, ears, and wing membranes of many bat species and can result in the death of the bat over the winter hibernation period. The disease has resulted in mass die-off of hibernating bat species in North America, with mortality rates as high as 80-100% in affected colonies.

Distribution

The fungus causing WNS, *P. destructans*, is native to areas of Asia and Europe. The disease was first discovered in a cave in New York State in 2006. It has spread voraciously and is now found in 43 states in the United States and all ten provinces in Canada, including BC, but is not yet found in the three Canadian territories. The first recorded case in western North America was in March 2016 in Washington State, about 150 km from the BC border. In 2022, the fungus was detected for the first time in BC within bat guano in the Grand Forks area.

Legal Status

White-nose syndrome is listed as an Early Detection and Rapid Response species on the BC Priority Species list, meaning that the fungus is determined to be high risk to BC and is new to the Province. The management objective in this stage is eradication.

Identification

White-nose syndrome is visually identifiable by the fuzzy white fungus which appears on the muzzles, ears, and wing membranes of infected hibernating bats. The fungus is no longer visible once the bats are active. However, other signs may include damaged wings and difficulty flying. Thin and/or dehydrated and furless areas appear wrinkled and flaky where the fungus has occurred. Bats with WNS may show behavioural signs as well, such as flying during the daylight and congregating near the entrances of caves and other hibernation areas in winter and early spring.

Bats infected with the fungus can experience fungal growth in the winter during hibernation when bats let their body

temperatures become cold (thermoregulation), and their dormant state results in a weakened immune system. The moist, cool conditions where bats tend to hibernate promote fungal growth, which then can lead to the WNS disease. This fungal growth disrupts physiological processes such as thermoregulation and causes them to warm their bodies prematurely to groom themselves and activate their immunity. By frequently warming in winter when there is no insect food available, the bats use up fat reserves too quickly and may not survive until spring. Even if they do survive the hibernation period, their wings may have been damaged by the fungus to such an extent that flight is compromised.

Ecological Characteristics

Habitat: When discovered on bats in 2006, this fungus was new to science and was named for the devastation it causes to bats. *P. destructans* thrives in cool, moist, and dark environments such as caves and mines. The fungus prefers environments in which the average temperature of the coldest month is $>0^{\circ}\text{C}$ and $<18^{\circ}\text{C}$ degrees Celsius. Thus far, 20 species of bats have been found with the fungus, and 12 species have been affected by WNS disease. WNS is only known to occur in hibernating bats.

Reproduction: *P. destructans* primarily produces asexually (clonal reproduction) and expands across areas which can support its growth. It is theoretically possible for the fungus to spread sexually as well, though this has never been observed in this fungus. Genetic relationships of the fungus across North America suggest widespread mixing and long-distance movement, with evolution and diversification resulting in some differences in growth and germination rates across its range.

Dispersal: Humans may unknowingly transport WNS via clothing, gear, and equipment that has been in bat habitats. Long-distance transport vessels such as semi-trucks, RV campers, truck trailers, and cargo ships may transport infected bats into new areas. The fungus is known to spread between bat-to-bat contact and contact with cold, damp areas where the fungus



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is present. The fungus is known in bat species that hibernate during winter, which make up 14 of the 16 BC bat species.

Impacts

Bats are important for healthy ecosystems. All bats in Canada eat insects, and different species of bats fill different roles in the ecosystem, feeding on different guilds of insects. For example, some bat species can pick insects and their larvae off of leaves! These types of bats appear during invasive insect outbreaks such as spruce budworm and thus play important roles in forest health.

Bats are important to the economy and our health. Bats provide billions of dollars in pest control services to North America each year (US\$3.7-53 billion for agriculture in the US alone). They are voracious eaters – for example, Little brown bats (*Myotis lucifugus*) can eat up to 600 mosquitos or other small insects per hour. Declines in bats may lead to increased pest invasion effects in forests and agriculture, and this has ramifications for the economy and human health. Rises in crop, forest, or biting insect pests are typically associated with costly pest control programs. For some industries, such as organic farming, chemical pesticides are not an option, depending on natural pest control services such as those provided by bats. Increased pesticide use can also trickle down to negatively impact human health.

Bats are significant to biodiversity in BC, accounting for more than 12% of mammal diversity in the province. We benefit greatly from this diversity, with different species of bats foraging in different types of habitats on different types of insects. British Columbia is the most bat-diverse province in Canada, with 16 of the 19 Canadian bat species. Half of these bat species are already of conservation concern.

Integrated Pest Management

Prevention: Gear and clothing that have been in contact with Pd-infected environments can spread the fungus to new locations. Decontaminate all clothing and gear before and after entering areas where bats may roost, such as caves and mines. It is important to reduce the chance of accidentally transporting a bat, for example, close cargo hatches, trailers, storage cabinets, RV awnings, and table umbrellas, to prevent bat translocation. Hitchhiking bats with WNS may bring the disease to new areas.

You can help by making others aware of the urgency and imminence of WNS, and the potential ecological and economic consequences. Working to reduce other threats to bats, such as habitat degradation and loss from forestry, urban, and agricultural expansion, will help bats persevere in the face of this crisis.

Clothing, boots, and equipment should be washed at greater than 55°C with water for at least five minutes. Large equipment and non-submersible gear can be cleaned with chemicals such as bleach and Clorox wipes following the product label, 70% alcohol, or 3% hydrogen peroxide.

Preventing WNS: Research is ongoing to test methods of reducing the severity of the disease or increasing the survival rates of bats exposed to the Pd fungus. Two potential disease mitigation tools have been identified as candidates

in the western US and Canada. While chemicals and other treatments such as UV exposure have been researched for use in bat refuges, these are unlikely to be of benefit in the western US and Canada, where few hibernation locations are known for bats. Instead, treatments that can be applied to bats at maternity roosts are being investigated. This includes a potential vaccine and topical bacterial probiotics.

Reporting

Do not handle living or dead bats. Please report bats that are seen flying or found dead during winter and early spring (November 1 to May 31) to the BC Community Bat Program at 1-855-922-2287 or info@bcbats.ca. <https://bcbats.ca/>

» Alternatively, the public can report online via the BC government website: Reporting Invasive Species (<https://www2.gov.bc.ca/gov/content/environment/plants-animals-ecosystems/invasive-species/reporting-invasive-species>) or to the ISCBC via the website, at info@bcinvasives.ca or 1-888-933-3722. <https://bcinvasives.ca/take-action/report/#websiteReportForm>

References/Links

Government of BC White-nose syndrome factsheet. https://www2.gov.bc.ca/assets/gov/environment/plants-animals-and-ecosystems/wildlife-wildlife-habitat/wildlife-health/wildlife-health-documents/white-nose_syndrome_fact_sheet_march_2017.pdf

Government of BC White-Nose Syndrome Webpage. <https://www2.gov.bc.ca/gov/content/environment/plants-animals-ecosystems/wildlife/wildlife-conservation/wildlife-health/white-nose-syndrome-wns>

White-Nose Syndrome Response Team Website. <https://www.whitenosesyndrome.org/>

BC Bat Action Team 2016-2020 Action Plan. <https://www.bcbat.ca/wp-content/uploads/2017/01/BCBAT-Action-Plan.pdf>

Phylogenetics of a Fungal Invasion: Origins and Widespread Dispersal of White-Nose Syndrome (2017). [https://journals.asm.org/doi/10.1128/mbio.01941-17#:~:text=Pseudogymnoascus%20destructans%20primarily%20reproduces%20asexually,conidia%20\(17%2C%2018\)](https://journals.asm.org/doi/10.1128/mbio.01941-17#:~:text=Pseudogymnoascus%20destructans%20primarily%20reproduces%20asexually,conidia%20(17%2C%2018))

U.S Fish and Wildlife Service White-Nose Syndrome March 2022 Article. https://s3.us-west-2.amazonaws.com/prod-is-cms-assets/wns/prod/e2e0f150-a606-11ec-81da-ab16efc2070f-White-nose%20fact%20sheet%202022_edit.pdf

Washington Invasive Species Council Factsheet. <https://invasivespecies.wa.gov/wp-content/uploads/2019/07/WhiteNoseSyndrome-FactSheet.pdf>

Fungus causing White-nose syndrome detected in BC (2023). <https://news.gov.bc.ca/releases/2023FOR0019-000426>

