What is White Nose Syndrome?

Scientific Consensus statement from a 2009 White Nose Syndrome Science Strategy Meeting in Texas:

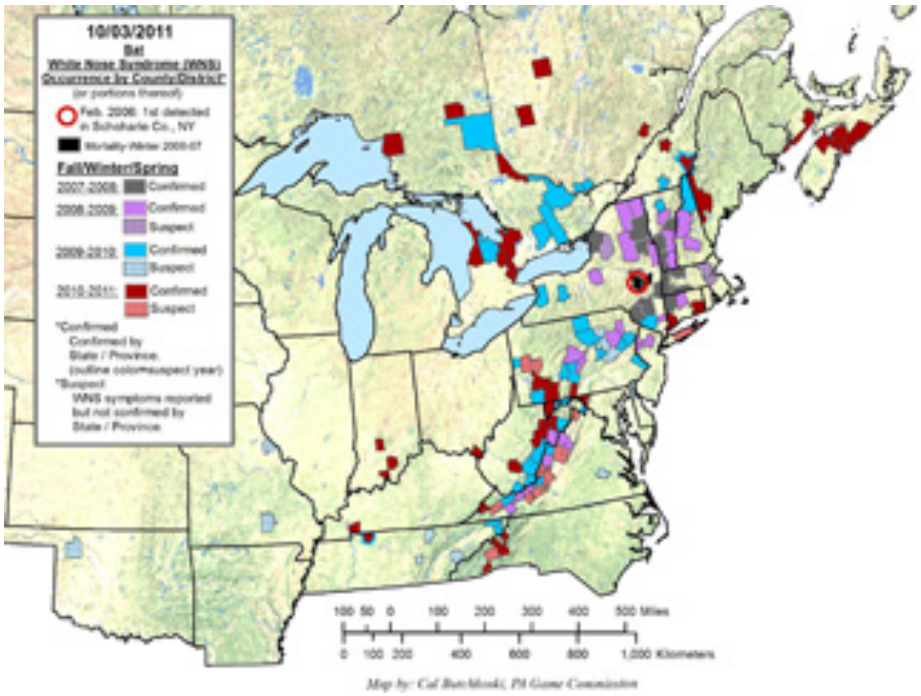
"White-nose Syndrome (WNS) is a devastating disease of hibernating bats that has caused the most precipitous decline of North American wildlife in recorded history. Since it was first discovered in 2006, WNS has infected six species of insect-eating bats in the northeastern and southern U.S., causing declines approaching 100% in some populations; estimated losses have exceeded one million bats over the past three years [5.5 million as of January 2012 - see below]. If the spread of WNS is not slowed or halted, further losses could lead to the extinction of entire species and could more than quadruple those that are federally listed as endangered in the U.S. Such losses alone are expected to have unprecedented consequences on ecosystem health throughout North America, with unknown economic consequences. Most bat species in North America feed on night-flying insects, of which many are pests of forests, agriculture, and garden crops or pose risks to human health. The number of insects consumed annually by one million little brown myotis bats is staggering—equivalent to 694 tons—emphasizing the extraordinary value of these bats to the normal function of both terrestrial and aquatic ecosystems. Establishment of a national comprehensive research program is urgently needed to identify underlying mechanisms causing WNS and to develop sound management solutions."

According to the US Fish & Wildlife Service:

In February 2006 some 40 miles west of Albany, N.Y., a caver photographed hibernating bats with an unusual white substance on their muzzles. He noticed several dead bats. The following winter, bats behaving erratically, bats with white noses, and a few hundred dead bats in several caves came to the attention of New York Department of Environmental Conservation biologists, who documented white-nose syndrome in January 2007. More than a million hibernating bats have died since. Biologists with state and

federal agencies and organizations across the country are still trying to find the answer to this deadly mystery.

We have found sick, dying and dead bats in unprecedented numbers in and around caves and mines from New Hampshire to Tennessee. In some hibernacula [places where bats hibernate], 90 to 100 percent of the bats are dying.



While they are in the hibernacula, affected bats often have white fungus on their muzzles and other parts of their bodies. They may have low body fat. These bats often move to cold parts of the hibernacula, fly during the day and during cold winter weather when the insects they feed upon are not available, and exhibit other uncharacteristic behavior.
Despite the continuing search to find the source of this condition by numerous laboratories and state and federal biologists, the cause of the bat deaths remains unknown. A newly discovered cold-loving fungus, Geomyces destructans, invades the skin of bats. Scientists are exploring how the fungus acts and searching for a way to stop it.

The Death Toll

The North American bat death toll exceeded 5.5 million from white-nose syndrome as of January 2012, according to a press release issued by the U.S. Fish and Wildlife Service.

On the verge of another season of winter hibernating bat surveys, U.S. Fish and Wildlife Service biologists and partners estimate that at least 5.7 million to 6.7 million bats have now died from white-nose syndrome. Biologists expect the disease to continue to spread.

White-nose syndrome (WNS) is decimating bat populations across eastern North America, with mortality rates reaching up to 100 percent at many sites. First documented in New York in 2006, the disease has spread quickly into 16 states and four Canadian provinces. Bats with WNS exhibit unusual behavior during cold winter months, including flying outside during the day and clustering near the entrances of caves and mines where they hibernate. Bats have been found sick and dying in unprecedented numbers near these hibernacula.

"This startling new information illustrates the severity of the threat that white-nose syndrome poses for bats, as well as the scope of the problem facing our nation. Bats provide tremendous value to the U.S. economy as

natural pest control for American farms and forests every year, while playing an essential role in helping to control insects that can spread disease to people," said Fish and Wildlife Service Director Dan Ashe. "We are working closely with our partners to understand the spread of this deadly disease and minimize its impacts to affected bat species."
Estimating the total number of bat deaths has been a difficult challenge for biologists. Although consistent population counts for federally listed endangered bats, like the Indiana bat, have been a priority for state and federal biologists, establishing population counts of once "common" bat species, like little brown bats, was historically not the primary focus of seasonal bat population counts.

"White-nose syndrome has spread quickly through bat populations in eastern North America, and has caused significant mortality in many colonies," said National WNS Coordinator, Dr. Jeremy Coleman, "Many bats were lost before we were able to establish pre-white-nose syndrome population estimates."

Bat Conservation International commented on this press release:

Because they hibernate in caves and mines, more than half of North America's bat species may be susceptible to this fatal disease. Estimates that bat populations have declined 88% or more at infected sites now seems more real than ever.

"We must redouble our efforts to deal with this terrible disease, and additional funding is crucial," said Fascione. "If WNS continues to take such a huge toll, the environmental and economic costs will be enormous."

Scientists estimate that one million bats would have consumed nearly 700 tons of insects per year. Since many of the insects eaten by bats are agricultural pests, losing more than 5.7 million bats will have expensive impacts on agriculture. Scientists across North America are searching desperately for solutions, but they have thus far found no way to cure WNS or to slow its relentless advance across the continent.

Loss of Bats Equals Loss to Humans

Redacted from the 2011 Annals of the New York Academy of Science, Ecosystem services provided by bats by Thomas H. Kunz, Elizabeth Braun de Torrez, Dana Bauer, Tatyana Lobova, and Theodore H. Fleming.

Various species of prominent agricultural insect pests have been found in the diets of bats based on identification of insect fragments in fecal samples and stomach contents. These insects include, but are not limited to,

- June beetles (Scarabidae),
- click beetles (Elateridae),
- leafhoppers (Cicadelidae),
- planthoppers (Delphacidae),
- the spotted cucumber beetle, (Diabrotica undecim- punctata, Chrysomelidae),
- the Asiatic oak weevil (Cyrtepistomus castaneus, Curculionidae),
- and the green stinkbug (Acrosternum hilare, Pentatomidae)

Based on the dietary composition, minimum number of total insects per guano pellet, number of specific agricultural pest species in each pellet, and the number of active foraging days per year, Whitaker calculated that a colony of 150 big brown bats (Eptesicus fuscus) in the midwestern United States annually consumes approximately 600,000 cucumber beetles, 194,000 June beetles, 158,000 leafhoppers, and 335,000 stinkbugs. Subsequently, assuming that each female cucumber beetle lays 110 eggs,86 this **average-sized bat colony could prevent the production of 33,000,000 cucumber beetle larvae (corn rootworms), which are severe crop pests *(See below)***.

While these calculations include a large number of assumptions and ignore various sources of natural variation, this study took the extra step of translating ecological data into a form more readily appreciated by the public. With the addition of data on corn rootworm damage to crops in the study area, an economic value for this colony could be estimated.

A common challenge in these investigations is the overwhelming lack of basic ecological information regarding foraging behavior and diet for many species of bats.

Although bat pollination is relatively uncommon compared with bird or insect pollination in angiosperms, it involves an impressive number of economically and/or ecologically important plants (Table 4). In arid habitats in the New World, two families, Agavaceae and Cactaceae, have enormous economic and ecological value. Many species of paniculate Agave rely heavily on phyllostomid bats for pollination, and many of these same bats are also major pollinators and seed dispersers of columnar cacti.

Three species of Leptonycteris bats are especially important in this regard in the southwestern United States, Mexico, and northern South America (Fig.

4). The bat-pollinated A. tequilana is the source of commercial tequila, a multimillion dollar industry in Mexico; other species of Agave are used locally to produce similar alcoholic beverages such as pulque, mescal, and bacanora. Agaves are also important sources of sisal fiber in many tropical localities. Although bats are not the exclusive pollinators of most species of Agave, they are critically important pollinators in tropical latitudes in the New World. This is also true of bats pollinating columnar cacti.

Examples of economic and ecological damage caused by insect pests consumed by bats

June beetles. Adults are herbivorous and have the potential to defoliate trees in large numbers; their larvae, white grubworms, attack the roots of grasses and various crops such as corn, wheat, oats, barley, sugarbeets, soybeans, and potatoes.

Wireworms/Click beetles. Wireworms, click beetle larvae, cause several million dollars worth of damage annually, and no crop is known to be entirely immune.

Leafhoppers and planthoppers. These true bugs are vectors of plant pathogens such as the rice dwarf and the maize mosaic viruses, as well as phytoplasmas and bacteria. The brown planthopper has resulted in cumulative losses of rice estimated in the hundreds of millions of dollars, and other species act as serious agricultural pests to potatoes, grapes, almonds, citrus, and row crops.

Spotted cucumber beetles (Diabrotica undecimpunctata). Serious pests of corn, spinach, and various cucurbit vines. In their larval stages, Diabrotica spp. (referred to as corn rootworms) decimate corn crops, costing farmers in the United States an estimated $1 billion annually in crop yields and costs of pesticide applications. ***The United States Department of Agriculture (www.usda.gov) reports that more hectares of cropland are treated with insecticide to control corn rootworm than any other pest in the United States.***

Stinkbugs. Serious pests of various crops including apples, pecans, soybeans, cotton, field corn, grain sorghum, peaches, and vegetables.252 Stinkbugs pierce plant tissues with their mandibular and maxillary stylets to extract plant fluids, which results in staining of the seed, deformation and abor- tion of the seed and fruiting structures, delayed plant maturation, and the predisposition to colonization by pathogenic organisms.

Gypsy moths. Serious pests of several hundred species of trees, bushes, and shrubs, both hardwood and conifer, and can lead to the complete defolia- tion when in high enough densities.253 Introduced into North America in the late 1800s, their range has continually expanded westward and now threatens temperate forested ecosystems throughout the northeast.

Tent caterpillars. Have irruptive population dynamics, generally advancing to pest status every year in some regions of the United States and causing considerable defoliation of trees over extensive areas.

Coneworms. Larvae feed within cones on cone scales and seeds of various species of firs and western pines, and can cause significant damage to fertilized conifer plantations and loblolly pine seed orchards.

Cutworms. Destructive garden pests, causing fatal damage to nearly any type of vegetable, fruit, or flower.

Tortrix moths. Many moths of the genus Cydia are economically important due to the damage they inflict on fruit and nut crops, and include notable pests such as the coddling moth, pear moth, alfalfa moth, and hickory shuckworm moth.

Snout moths. Members of the genus Acrobasis feed on a wide variety of shoots, nuts, and fruits including alders, birches, hickories, pecans, and cranberries.

Corn earworm and tobacco budworm moths. Rank among the top pests in the United States in damage caused to crops and number of insecticides applied to crops to control them.260 In Texas, corn earworms are present in an estimated 98% of corn- fields. Each female corn earworm moth potentially lays over 1,000 eggs in her lifetime,261 which then develop into larvae that infest corn, cotton, or other crops.