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Mysterious Northeast Bat Deaths Now in 9 States and Headed Toward Kentucky

"This bat die-off is unprecedented and this precipitous decline we have seen is probably the greatest loss of wildlife in North America in at least a century." - Thomas Kunz, Ph.D., Boston University

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Eight Little Brown Bats hanging upside down in hibernation west of Albany, New York, inside Hailes Cave in February 2007. Unidentified white fungus rings the noses on seven. Bat mortality in two caves affected by the white-nose syndrome was 90% and 97%. By February 2008, the white-nose syndrome has spread to twenty caves in New York state, southwestern Vermont and western Massachusetts. By spring 2009, at least a million bats have died in nine states and Kentucky could be next. Image © 2007 by Nancy Heaslip.

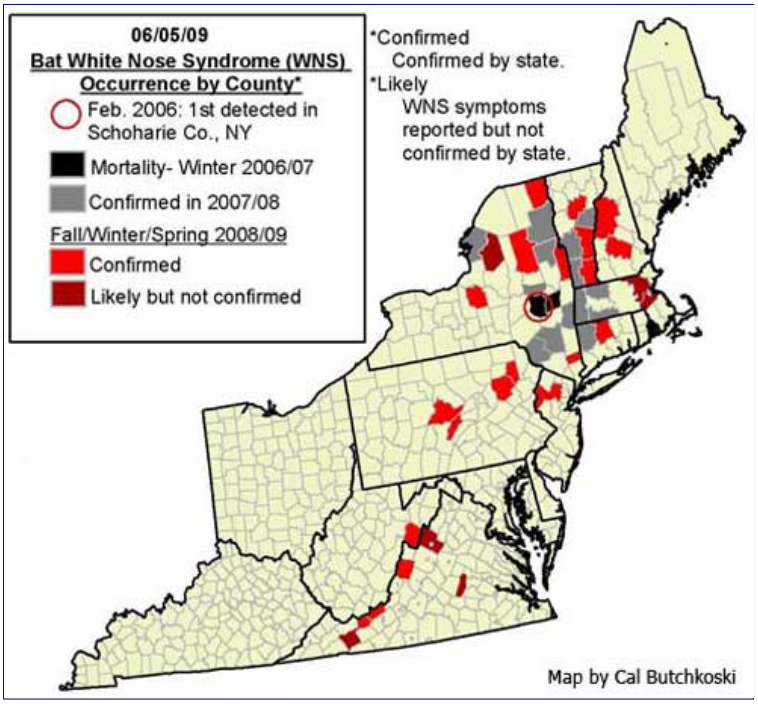
Little Brown Bat (*Myotis lucifugus)* hibernating in West Virginia cave has white ring of the never-before-seen fungal genus, now named *Geomyces destructans*, around its nose and on its ears. Image © 2009 by Craig W. Stihler, Ph.D., West Virginia Dept. of Natural Resources.

June 26, 2009 Boston, Massachusetts - Bats are dying in the Northeastern United States at a rate never seen before by scientists and the leading culprit is a fungus that was finally named this month for what it does: *Geomyces destructans.* It's a brand new fungus never seen before. Bats are mammals and mammals have never been destroyed by a fungus like this before either.

But at least one million of the cave-dwelling creatures - that fly through the air eating their weight in insects every night - have died since February 2007. The mysterious deaths are called the "white-nose syndrome" (WNS) because the dead bats have white rings of fungus around their noses, on their ears and faces. Yet, many bat experts are not convinced that the new fungus is the cause of the bat deaths; the fungus might be an opportunist on bats weakened by something else – very similar to the mysterious Colony Collapse Disorder killing off honey bees.

By May 2009, scientists came together in Austin, Texas, for a meeting hosted by Bat Conservation International. I have talked with several scientists who were there and the bottom line is: the white-nose syndrome is spreading much faster than expected and no one yet knows how to stop it. Since the first cases in New York State two years ago, the *Geomyces destructans* fungus has been confirmed in nine states:

1. Vermont
2. New Hampshire
3. Massachusetts
4. Connecticut
5. New York
6. Pennsylvania
7. New Jersey
8. Virginia
9. West Virginia



Map presented at June 4, 2009, joint House oversight hearing of Subcommittee on National Parks, Forests and Public Lands and the Subcommittee on Insular Affairs, Oceans and Wildlife of the U.S. House Committee on Natural Resources to show bat deaths have expanded from New York in February 2007 to now include nine states, with Kentucky (lower left) probably next. Hearing entitled: "White-Nose Syndrome: What's Killing Bats in the Northeast?" Map by Cal Butchkoski, Bat Conservation and Management, Inc.

The loss of a million bats means that 700 tons of insects are free on the landscape, uneaten by those million, dead bats. All those insects will eat more crops and cause farmers to spray even more dangerous pesticides that ironically might be the major problem in both the bat die-off and honey bee disappearances.

As the bat deaths spread, scientists are calling this an urgent emergency in which at least six species of bats could end up extinct if the white-nose syndrome is not stopped. Finally, Congress is paying attention. On Thursday, June 4, 2009, the Subcommittee on National Parks, Forests and Public Lands and the Subcommittee on Insular Affairs, Oceans and

Wildlife of the U.S. House Committee on Natural Resources held a joint oversight hearing entitled: "White-Nose Syndrome: What's Killing Bats in the Northeast?"

One of the bat experts who testified before Congress was Thomas H. Kunz, Ph.D., Prof. of Biology and Director of the Center for Ecology and Conservation Biology, Boston University in Boston, Massachusetts. Recently I asked Prof. Kunz about the rapid spread of white-nose syndrome (WNS) and what other states might be next?

Interview:

Thomas H. Kunz, Ph.D., Prof. of Biology and Director, Center for Ecology and Conservation Biology, Boston University, Dept. of Biology, Boston, Massachusetts: "If white-nose syndrome continues to spread at the rate that it has in the last few years – we're talking about a 200 mile spread a year. There is nothing in the historic written record that suggests this has occurred anywhere in the world before, so it's a very devastating condition. This bat die-off is unprecedented and this precipitous decline we have seen is probably the greatest loss of wildlife in North America in at least a century.

IF THIS HAS SPREAD IN THE PAST YEAR INTO VIRGINIA AND WEST VIRGINIA, WHAT ARE THE CHANCES THAT IT WILL SPREAD INTO KENTUCKY, MISSOURI, OHIO – THOSE STATES ARE BORDERING THE WESTERN ENDS OF VIRGINIA.

That's correct, and the rate at which it has been moving the last three years, especially the last year, I would say it's almost guaranteed that we it will be spread into at least Kentucky and Tennessee and perhaps into Missouri and Arkansas in places where some of the largest known number of hibernating species of hibernating bats occur in the world.

IF THAT HAPPENS, KNOWING THAT WE'VE LOST AT LEAST A MILLION BATS SO FAR AND IF THIS SPREAD INTO MISSOURI, KENTUCKY AND OHIO, WHAT ARE THE IMPLICATIONS FROM YOUR POINT OF VIEW?

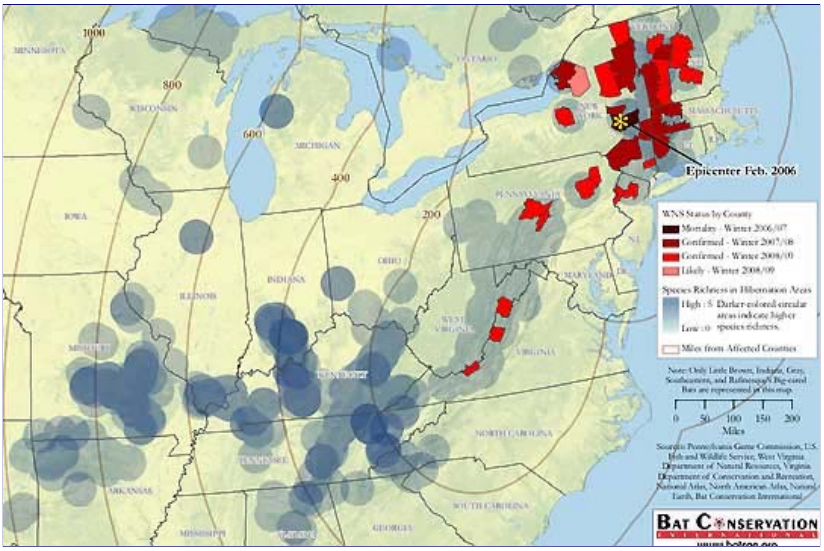
Well, they are devastating! Without these bats, this can have a devastating affect on agricultural crops and on gardens and forest trees because these bats feed on the aerial insects that lay eggs on various kinds of plants in which the eggs hatch out into larvae that then feed on the foliage.

One Million Bat Deaths Means 700 Tons of Insects Not Eaten

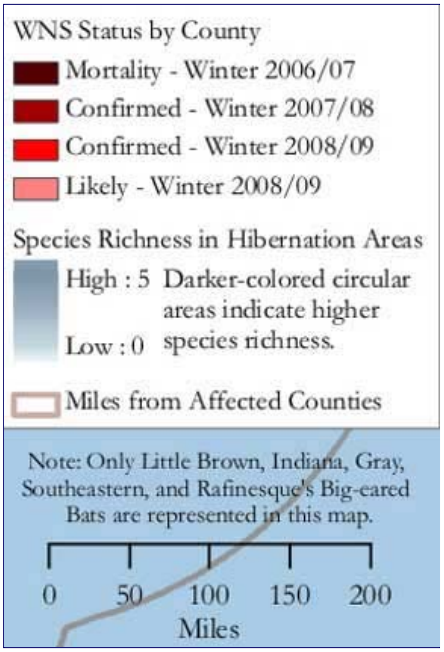
IN ONLY A YEAR TO 18 MONTHS, WE HAVE LOST AT LEAST A MILLION BATS AND THAT'S EQUIVALENT TO ABOUT 700 TONS OF INSECTS. THE WHITE-NOSE SYNDROME CONTINUES TO SPREAD WESTWARD - PERHAPS NEXT INTO KENTUCKY. IF THE NUMBER OF BAT DEATHS REACHED AROUND 4 MILLION, WOULD THERE BE SUCH A HUGE SPIKE IN INSECTS THAT WE WOULD SEE MORE INSECTS AROUND US?

That is correct. We'll see more insects around us and we'll see more damage to plants on which the insects tend to feed. With fewer bats, we are going to see more insects.

Potential Spread to Hibernacula West of Virginia



Red marks white-nose syndrome confirmed infection sites. The blue-grey circles extending westward are bat hibernacula for Little Brown, Indiana, Gray, Southeastern and Rafinesque's Big-eared bats. The worry is that Kentucky caves will be hit next and that the white-nose syndrome will continue to spread westward and even into the south. Map sources: Pennsylvania Game Commission; U. S. Fish and Wildlife Service; West Virginia Dept. of Natural Resources; Virginia Dept. of Conservation and Recreation, National Atlas, North American Atlas, Natural Earth and Bat Conservation International.



PROF. KUNZ, WITH THE WHITE NOSE SYNDROME NOW IN 9 STATES CONFIRMED AND WITH THE FEAR IT COULD SPREAD INTO THE MID-WEST THIS YEAR, WHAT IS YOUR ESTIMATE ABOUT HOW MANY BATS HAVE DIED SO FAR AND HOW BAD COULD IT GET?

Well, our best estimate right now in the Northeast in the last three years since it's been observed, we've estimated at least 1 million bats have died. This is based on direct observations of bats inside caves. Just to give you an example, some of the caves up in upstate New York and in Vermont this last year, many of us who visited these sites and walked into these caves, you could not find a place on the floor of the cave where you could put your foot without stepping on a dead bat. Literally tens of thousands of bats have died in some of these major large hibernacula.

THAT'S ABOUT 95% TO 100% MORTALITY?

Yes, in those sites, it's 95% to 100%.

Prof. Kunz provided the above images to show what a cave with 100% deaths of Little Brown Bats looks like and there is evidence of bats dead in the snow indicating the creatures woke up and tried to leave the cave. Location is Aeolis Cave in Vermont. Image © 2009 by John Reichard.

Hibernating Little Brown Bats crowded together to keep warm,

about 300 animals per square foot. Image © 2007 by Alan Hicks.

EVEN BATS THAT HAVE SURVIVED THE WINTER AND GOTTEN OUTDOORS ARE STILL SICK AND NOT THRIVING?

That's right. There are two reasons for that. One of the problems in wintertime is these (sick) bats are rousing in mid-winter without any fat left, basically getting back to the question of what do we know? We know they run out of fat reserves that they put on during the fall of the year. The bats aren't going to add anything to those fat reserves because there is nothing to eat during the winter. But the sick bats are sometimes arousing in mid-winter and going out and flying around when there is still snow on the ground and it's cold outside, it's freezing. And some of these bats end up with damage to their very fragile wing membranes. There is frostbite. There is also the white fungus that is attacking the wing membranes.

What we see of the bats returning to the maternity colonies in the spring, at least those who survived, many of them have damaged wings. They have scarred and necrotic wings; that is, the tissue is basically dying and sloughing off. Because the wings are really the lifeblood of bats. And we're finding bats at the summer colonies that have badly damaged wings.

In my knowledge, this rapidly expanding bat die-off is the most devastating and precipitous decline that we've ever seen in North American wildlife.

The fungus, *Geomyces destructans*, looks like white powder on the very thin wing of an infected bat in February 2008. Image © 2008 by Craig W. Stihler, Ph.D., West Virginia Dept. of Natural Resources.

Fungi Not Known Before to Decimate Mammals

I CAN'T FIND ANY OTHER EXAMPLE KNOWN WHERE FUNGI WOULD TAKE OVER AND DECIMATE MAMMALS.

That's correct. This is part of what we don't know right now. Obviously, the fungus is associated and that's why it is called white nosed syndrome. There is no proof yet that this fungus is the killer, actually killing the bats.

There is no evidence that any fungus kills mammals. We know there are a lot of fungi that do affect humans, from athlete's feet to ringworm and so on. These are fungi and they cause skin irritation. What we do know is that fungi grow on dead, organic matter in dark, moist places. [Editor's Note: Bats hibernate when temperatures are between 5 to 14 degrees Celsius/41 degrees to 57.2 degrees Fahrenheit, which is also the temperature range in which the new *Geomyces destructans* fungus thrives.]

New Fungus *Geomyces destructans* Attacks Bat Wings and Dermis

But we also know that this particular fungus *Geomyces destructans* is a new species that was not known before the first bat deaths in New York caves in December 2006 to February 2007. This particular fungus on bats – the histopathological studies show the fungus does invade the dermis, the living part of the skin. Epidermis is dead cells; the dermis is alive where vascularity and blood are. This fungus invades the dermis by entering through the hair follicles and the sebaceous glands, the skin glands.

The preliminary studies that have been done on the genome, the genetic characteristics of this particular fungus, wherever it has been tested and examined from caves throughout the Northeast, they are all the same. From every cave and mine that has been sampled, the fungus is genetically identical, which indicates and suggests that this is a recent introduction, or recently evolved. It could be a condition introduced either by humans or perhaps by other bats from some other place. We don't have any evidence it's the bats.

Geomyces destructans Fungus Appears "Cloned" Cave to Cave

YOU'RE SAYING THAT THIS NEW FUNGUS IS SO IDENTICAL THAT IT ALMOST LOOKS CLONED IN ALL THE INFECTED CAVES?

That's right.

WHERE DO YOU THINK IT MOST LIKELY CAME FROM?

We know that the fungus is transmitted or transferred from place-to-place by fungal spores. Spores can be carried on the fur of bats. It can be carried on the shoes and clothing of a human that might visit some of these caves. And it can also be transmitted through the air because spores can be transported through the air. Those are all three options about how this is being transmitted.

Based on the fact that bats fly and the spread of it has occurred to so rapidly to such a wide range of caves, it is unlikely that humans would be the only mechanism by which it is transmitted.

BUT WHY WOULD A FUNGUS THAT NO ONE HAS SEEN BEFORE IN NORTH AMERICA SUDDENLY BE SO LETHAL TO ANCIENT BATS?

Because there is no resistance. These bats from Europe and North America have been separated by millions of years. One hypothesis is that the bats that have a fungus growing on them in Europe (but not dying) might be the remnants of a much larger population. And this is what we would predict here in the U. S. There are going to be survivors, but the survivors are going to be just remnants of the original population that is being killed.

Right now, there are investigators in Europe comparing the genetic characteristics from bat fungus there to what is being observed here in North America.

BUT THE BATS IN EUROPE DID NOT DIE AT 95% TO 100% IN CAVES AS HAS HAPPENED IN THE UNITED STATES?

That is correct. But again, that might be because the bat colonies in Europe are much smaller. Historically, they might have been much larger. We just don't know that. It could have been thousands of years ago that this fungus crash could have occurred and the ones that are still carrying the fungus might be the survivors that over time have developed resistance to the fungus.

There are several areas of research we are trying to do. One is looking at the immune system of the white nose syndrome infected bats. The immune system of bats is not well understood. There are some studies going on in my lab. There are some going on at Bucknell University in DeeAnn Reeder's lab. [**See 022609 Earthfiles.**] There are also some places in Europe that are looking at the immune system of the bats there. So, we don't have an answer yet.

Bats Have Very Low Reproductive Rates, So Extinctions of Some Species Possible and Recovery of Others Will Take Decades

IS IT TRUE THAT IF THE SIX SPECIES OF BATS CONTINUE TO DIE THAT EVEN IF

SCIENCE CAN GET A HANDLE ON STOPPING THE WHITE NOSE FUNGUS, IT TAKES A LONG TIME FOR BATS TO RECOVER?

It takes an enormous time for bats to recover, largely because they have very low reproductive rates. Most species of those 6 species I've talked about – 4 of them produce one baby per year. Two species produce two babies per year, although only one survives to weaning. So the bat reproductive rates are very low and their recovery time would take hundreds of generations to return to a current population today.

DO YOU THINK THAT MEANS SOME OF THE ENDANGERED BATS COULD GO EXTINCT?

Yes, I really think the Indiana Bat is at great risk. They have only a few major hibernacula, about eleven major hibernacula. There are some smaller ones, but these occur in Indiana, some of Pennsylvania, Kentucky, Tennessee and Missouri. Those are the major hibernacula where this particular Grey Bat species exists.

There are other species beyond the Midwest, as you go into Oklahoma and Texas and Kansas. There are major hibernating colonies such as the Cave Bat. This is another bat that might be at risk in the next four to five years.

In the far West, there are not many species that form large colonies. Most of them are different species that tend to form smaller colonies, so I would not predict the spread to occur in the West at as rapid a rate as it has in the East, if it does spread there at all.

Bat Hibernation Environments: Could White-Nose Syndrome Spread to the West?

One thing we have to think about, too, is the environment in which bats hibernate. I gave the range of temperatures we know the white nose fungus tends to grow optimally, between 5 and 14 degrees Celsius. So, as you move into the deep South, there certainly are bats that hibernate for short periods of time – winter in Louisiana and Alabama is not as long as it is here in the Northeast or even in the Midwest. But these are still – the potential for the fungus to survive even short periods of time for a month or so is very possible.

SO, PROF. KUNZ, DO YOU MEAN THAT THE WHITE-NOSE FUNGUS SYNDROME COULD GO ALL THE WAY FROM THE EAST COAST OF THE UNITED STATES, EXTEND INTO THE MIDWEST AND SOUTH AND ALL THE WAY TO THE ROCKY MOUNTAINS?

Yes, it could. Part of the reason it could is that at least the hypothesized mode of transmission – this is another unknown – to what extend the fungus is transmitted by bats? And to what extent is the fungus transmitted by humans? And transmitted by air? We suspect all three routes, but it's probably not equal how it's transmitted from one area to another.

Is the *Geomyces destructans* Fungus the Killer? Or Opportunist Upon Another Bat Problem?

Inadequate supply of poly-unsaturated fatty acids in the bats fall diets could be linked to chemical pesticides killing off specific insects needed for quality fat content before hibernation.

SINCE A FUNGUS HAS NOT BEEN KNOWN TO KILL MAMMALS BEFORE IN THE PAST LIKE THIS, DO YOU SPECULATE ABOUT WHAT IT IS IN THIS PARTICULAR BRAND NEW FUNGUS THAT IS ABLE TO KILL BATS SO QUICKLY?

We're not certain that the fungus is actually killing the bats directly. It's certainly irritating the bats. We suspect that is occurring. And the deaths might be a consequence of losing their body fat by mid-winter; thus, the bats are not able to arouse, or they die before they are able to arouse. Or the bats fly outside in mid-winter and freeze.

So, I wouldn't yet state that the fungus is killing. That's something we don't know. We know the fungus is associated with the bats that are dying. And going back to the hypotheses of what is causing the loss of body fat, it could be the irritation (by fungus under dermis) that causes arousal, or it could be the inadequate supply of poly-unsaturated fatty acids in the diet in the fall.

Could Bats Be Vaccinated Against the Fungus?

The more realistic, although daunting task of stopping this, might require the development of a vaccine against the fungus. Although one could ask, 'How could you possibly vaccinate millions of bats?' You might not be able to vaccinate all of them, but you might be able to vaccinate many more that would be able to survive and reproduce versus those that are going to die without any kind of vaccine.

The vaccine, if it could be developed, and we know that vaccines against fungi have been developed for other animals and humans. This would most likely involve an injection. You'd have to handle thousands of bats during the active season. Typically, it would happen during what is called the fall swarming period where you would mount a major effort of wildlife biologists going and trapping bats as they enter these swarming sites, injecting them with an appropriate dose of vaccine that at least on a single dose be able to kill the fungus.

So, there are a lot of uncertainties in all of this, but I think the vaccine approach probably has the least difficulties in accomplishing a slowing down the number of fatalities you would expect to see over the next five years.

BUT PROF. KUNZ, HAS THERE EVER BEEN A VACCINATION PROGRAM BY HUMANS TRYING TO VACCINATE SO MANY CREATURES?

No. There have been efforts to vaccinate wildlife, for example, against rabies and that has been done in many parts of the world where the way that vaccine is administered is through the food; that is, putting vaccines in food for carnivores or scavengers or omnivores like raccoons and foxes. Rabies has been reduced considerably as a consequence of using a vaccine that can be administered orally. So, there is a history there, but not in the case of bats. And there is no evidence that we can even develop the vaccine.

Vicious Cycle: We Need Bats to Control Insects, But Human-Applied Pesticides Could Be Killing the Insects the Bats Need to Survive

HOW STRANGE IT IS TO REALIZE IS THAT ONE OF THE THINGS THAT YOU SCIENTISTS ARE LOOKING AT IS WHAT IMPACT DO PESTICIDES HAVE ON INSECTS THAT COULD AFFECT THE FOOD OF BATS THAT ARE NOW DYING IN GIGANTIC NUMBERS FROM AN UNKNOWN FUNGUS AND THAT IT MIGHT ALL CIRCLE BACK TO THE PESTICIDES KILLING INSECTS THAT BATS NEED TO SURVIVE AND THAT HUMANS DEPEND ON THE BATS TO CONTROL?

Absolutely! I have to say I agree with you completely. It's a very unbalanced world when you have to apply pesticides to kill insects that would provide food for bats. The problem is that the pesticides are not specific to any one kind of insect, so you've got a broadband pesticide that ends up killing lots of prey (the bats) that would normally be eating a lot of the insects.

CAN YOU IMAGINE A PLANET WITHOUT BATS?

Personally, no. Professionally, no. Economically, no. This is an urgent issue. It needs to be addressed sooner than later. It's already been three years and we have very little funding from the federal government. There has been some, but not very much. The bulk of the research has been by private sources; that is, non-government organizations and Bat Conservation International and the National Speleological Society. If it had not been for those two organizations, we would still be sitting here waiting to answer some of the questions we've been able to work on.

Unfortunately, when this whole thing hit us here in the Northeast, no one was prepared for it. No one was prepared – not only we didn't have the science behind it to really know how many bats we were dealing with. We still don't know much about the insects. We don't know much about the pesticides that are being used. We did not know very much. What little we do know was funded largely by private sources and non-government organizations.

BOTTOM LINE: WITH, OR WITHOUT, MORE RESEARCH FUNDING, THE EXPECTATION IS THAT THE WHITE NOSE FUNGUS SYNDROME WILL CONTINUE TO SPREAD AT LEAST FOR ANOTHER 12 MONTHS.

That is correct.

Since 2006, Bats Began Dying, Bees Began Disappearing and Amphibians Have Also Been Killed by A Fungus

FINALLY, IN THE BIG PICTURE, WHAT IS YOUR OWN PERSONAL OPINION ABOUT THE FACT THAT FOR THE FIRST TIME ON RECORD, BATS ARE DYING FROM A FUNGUS THAT NO ONE HAS EVER SEEN BEFORE? SIMULTANEOUSLY, COLONLY COLLAPSE DISORDER IN HONEY BEES AND POLLINATORS HAS BEEN ONGOING AT ABOUT THE SAME TIME PERIOD FROM THE FALL OF 2006 TO NOW. THE *CHYTRID* FUNGUS HAS BEEN ATTACKING AMPHIBIANS. WHEN YOU LOOK AT ALL THREE OF THOSE HAPPENING AT THE SAME TIME, WHERE DOES YOUR MIND GO AS A SCIENTIST ABOUT WHAT ELSE IS WRONG IN THE PLANET THAT IS CAUSING ALL OF THIS?

Well, you can add birds to this as well. The decline of the aerial-feeding birds. It is devastating to know that we are losing large numbers of species of frogs from the chytrid fungus, to bees to bats. That should be sending a signal – not only to our government officials who have to make decisions about funding to address these issues, but it should send a message to the public that our environment is drastically being altered and these are the sentinel animals. The little animals are the ones most affected by whatever – if it's a contaminant or whether it's a pathogen or whether it's an invasive species. We're not talking about one species. We're talking about many species and the cascade effect that all this mortality has on our ecosystems should say to us that we humans are next! We are not immune to these kinds of conditions. We've already seen this in humans in many ways – conditions that cause asthma and diseases of various sorts – neurological diseases – the presence of mercury in the environment – and acidification of lakes affects the local economies in terms of the fishing industry and recreational industry. So, there are cascade effects here that go far beyond loss of animals.

But as someone who is a biologist and who has a deep passion for animals and plants and all life, we need to do everything that we can to protect and to conserve what we have and to minimize losses that would ultimately have affects on human life.

BECAUSE WE'RE ALL LIVING ON THIS PLANET TOGETHER.

We all live on this planet together and I think these are wake up calls! It's unfortunate that wake-up calls come a bit late here.

What Happens Next in Congress about the Unprecedented Bat Die-Off?

WHAT DID YOU AND YOUR COLLEAGUES PROPOSE TO THE JOINT HOUSE SUBCOMMITTEES THAT COULD NEXT BE DONE MAYBE TO GET ON TOP OF THIS SITUATION?

We need more money to really answer the question: Is the fungus a true pathogen? Is it killing the bats? If it is, how do you stop this fungus? How do you reduce or stop its spread?

WHAT HAPPENS NEXT WITH THE SUBCOMMITTEES IN THE HOUSE? IS IT GOING TO EXPAND TO THE SENATE? WHAT DO YOU EXPECT TO BE THE NEXT STEPS COMING OUT OF THE HEARING?

Those of us who testified have been asked to follow up our testimony with additional information we might have in the next 30 days. We've been asked to revise our budget, which will expand from what we originally proposed, largely because that budget was based on how to deal with the white nose in the existing range and not projecting out to where it could be.

YOU MEAN KENTUCKY, OKLAHOMA AND BEYOND?

Right. We don't have a budget for that at this point, but we'll have a budget in another week or so that will probably double $17 million. We'll probably be in the $30 million range to really get baseline data that is necessary to address what's happening in the areas not affected.

DOES CONGRESS APPEAR TO BE SUPPORTIVE OF YOUR EFFORTS?

The two subcommittees, the chairs, were very supportive and acknowledged this is a major problem. We expect to have a hearing in the Senate, but it has not been scheduled yet, but Senator Leahy from Vermont is leading this and we expect a Senate hearing within the next month. What we're asking for is we can't wait for another year. We really need research funds now. If we wait another year, we lose another year of trying to answer these questions. So, we've asked for not only stimulus money that might still be available for research that can be done in the next six to eight months. After that, we go into another fiscal year and this is all too urgent to wait.

We need urgently to get the federal government and the Congress to get it started. We're going to depend upon the Chairs of these two subcommittees to take it further into the Dept. of Interior to the Secretary of Interior and then ultimately to hopefully the President who will sign off on this and money will be released. But as you know, political decisions are slower than we would like them to be.

We're not going to be able to do anything about the spread in the next year. We're going to watch it happen. We can monitor it and do some research if we have some funding. But if we don't have any funding, we can't get started to identify, to do the experiments to clarify and make certain the fungus is the silver bullet. We're not going to be able to do the research that can answer that question. We're not going to be able to do the research, if it is the fungus, to develop a vaccine. We're not going to have the funding to do the monitoring at sites that are not affected, but likely will be affected over the year. And we have to have that kind of base line data to figure out how to stop *Geomyces destrutans.*"

For further reports about bat die-offs, honey bee Colony Collapse Disorder and amphibian decline in which over-use of chemical pesticides might be a root cause, please see reports below in **Earthfiles Archive:**

• 03/30/2009 — European Honey Bee Decline Continues While Aggressive Africanized Honey Bees Attack in Southern U. S.
• 02/26/2009 — Unprecedented Northeast Bat Die-off Spreading Rapidly
• 09/26/2008 — NRDC Sues EPA for Honey Bee Lab Data and EPA Approves Another Bee-Killing Pesticide
• 08/31/2008 — Honey Bees Not Healthy in U. S. or U. K.
• 08/15/2008 — Amphibian Warning Bell of Mass Extinctions
• 04/10/2008 — Honey Bee Collapse Now Worse on West Coast
• 04/10/2008 — Honey Bee Collapse Now Worse on West Coast
• 02/29/2008 — Mysterious Bat Deaths in New York, Vermont and Massachusetts
• 01/18/2008 — Amphibians Dying Out At Alarming Rate
• 10/13/2007 — Now Bumblebees Are Disappearing, Too.
• 09/26/2007 — North American Honey Bees Still Weak
• 09/07/2007 — Honey Bee DNA Study Finds Australian Virus in Colony Collapse Disorder
• 06/28/2007 — Hackenberg Apiary, Pennsylvania - 75-80% Honey Bee Loss in 2007. What Happens If Colony Collapse Disorder Returns?
• 05/04/2007 — Environmental Emergency Updates: Part 1 - Spreading Honey Bee Disappearances - Nosema ceranae Not the Answer?
• 04/06/2007 — Collapse of Honey Bees in U. S., Canada and 9 European Countries
• 03/17/2007 — Honey Bee Disappearances Continue: Could Pesticides Play A Role?
• 02/23/2007 — Scientists Hope "Amphibian Arks" Can Save Frogs and Toads
• 02/23/2007 — Part 1: Earth Life Threats - Alarming Disappearance of Honey Bees

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Websites:

Joint House Subcommittee Hearing on White-Nose Syndrome:
http://www.caves.org/WNS/Hearing%20on%20WNS.htm

Bat Conservation International:
http://batcon.org/index.php/what-we-do/white-nose-syndrome.html

Bat Conservation and Management: **http://www.batmanagement.com/wns/wns.html**

U.S. Fish & Wildlife Service, Northeast Region: **http://www.fws.gov/northeast /white_nose.html**

Geomyces destructans Named: **http://botit.botany.wisc.edu/toms_fungi/may2009.html**

National Speleological Society: **http://www.fws.gov/northeast/white_nose.html**

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