

White Nose Syndrome Grant: Bat Lab

Madeline Chervenak, Jonathan Rivera, Sydney Rossano

Introduction

WNS, also known as White Nose Syndrome, is a deadly disease that is rapidly spreading and putting little brown bats in serious danger. Due to the fungus, *Pseudogymnoascus destructans* (Pd), capability of thriving in cold, damp, and dark environments, it is affecting the bats during their most vulnerable time, hibernation. The fungus is a white fuzz that will attach to the bats body and cause them to behave erratically. While the little brown bats are in hibernation, the fungus removes them from their inactive state and causes them to become active and burn the fat that is necessary to survive throughout the winter.

According to U.S. Fish and Wildlife Service, in order to help bats survive and overcome this disease we must make a change to the susceptible host (LBB), the conducive environment, or the pathogen itself. Creating a change will prevent or lessen the negative effects that are rapidly declining the rate of healthy brown bats. As of right now, there are various disease treatments that are in works, unfortunately biologists have yet to find the cure to treating bats suffering from this disease. There is further work that must be done in order to successfully find the cure and put an end to the spread of this deadly fungus.

In an article written about anti-fungal immune response in little brown bats they stated that “[...] most proposed methods would require treatment of bats in the winter, and treatment application when bats are hibernating may be problematic or impractical for some species.” Rocke et al. (2018). Due to the fact that this is occurring during hibernation, it can be tricky for biologists to conduct studies and test methods in caves. With that being said, biologists would need a controlled environment, similar to the bats natural habitat. Thus leading to our product, a scientific lab in a man-made bat house made out of wood with insulation and electricity. The bat houses will be an enclosed environment that includes thermostats to control the temperature, as well as the humidity. A thermal camera system will be included in the bat houses so that observation can take place from another lab, but there will also be space in the house for testing and observation. Boyles and Willis (2010) stated that “it would be reckless to attempt an intervention that might prolong survival of affected bats in the wild.” With that being said, in developing these facilities, it will allow biologists to study little brown bats with white nose syndrome and test their possible cures in a lab-like environment with the necessary tools and materials, reducing the chances of spreading the fungus within their natural habitats.

The criteria for success for our bat environments would be creating a space where biologists can safely and strategically test possible cures for white nose syndrome. As well as reducing the spread of white nose syndrome due to the infected bats being taken out of the caves and brought to a special lab. In this lab the bats should be able to stay in their hibernation state, regardless of being infected by the fungus. The ultimate goal would be that one of our bat houses would be used to successfully find the cure and at least ensure future little brown bats a healthy life, free of WNS. By creating a controlled environment we are taking the first necessary steps to develop and identify the necessary methods to prevent any future cases of white nose syndrome within the little brown bat community. As a result, the spreading of this disease would come to a halt.

Method

<u>Description of Steps</u>	<u>Time Frame (finished by)</u>
Gather materials/hire builders	April 2020
Cross-check blueprints	May 2020
Begin construction	May 2020
Gather bats exhibiting WNS	July 2020
Gather teachers and bat experts to develop an educational outreach program touting the benefits of bats	September 2020
Finish development of educational outreach program/begin implementation and fundraising	October 2020
Finish construction of initial enclosure/introduce bats to enclosure	Late September/ Early October 2020
Begin observations of bats pre-hibernation	October 2020 through early November (temp. dependent)
Bat hibernation begins	November 2020
Conduct observations/test variables	November 2020-March 2021
Final analysis of results	April 2021
Publish results	April 2021

Method cont.

The first steps will be to begin construction of the bat enclosures. Gathering the materials should take approximately one month. We will have to hire carpenters, plumbers, and a bat expert to ensure that the enclosure meets the needs of the bats. We will provide the blueprints and the raw materials. A permit will be required to capture bats known to be infected with WNS. The blueprint will be cross-checked by all involved parties to ensure compliance with animal enclosure codes. Construction of the bat enclosure will begin as soon as the green light is given and all permits approved.

During construction we will enlist the help of bat experts to go out into the field and gather bats that exhibit symptoms of WNS. The ideal specimens would be bats that are just beginning to show the signs of WNS, since we would like to see how they are affected throughout the year prior to hibernation. A harp-trap placed in front of a cave infected with WNS will be used to gather the bats in a humane way. An educational outreach program will also be created during this time. The purpose of the outreach is twofold: A program aimed at educating children on the importance of bats to our natural ecosystem, and a program aimed at the general public describing the benefits of having bats present within neighborhoods and to prevent the layman from calling for an exterminator as soon as they see bats present in their basements and/or attics, since these are places that bats may choose to hibernate in instead of within WNS infested cave systems.

Construction for the enclosure will be completed by late September/early October. Once completed the WNS infected bats will be introduced into the environment. This will give scientists approximately one month to observe the bat's behavior prior to hibernation. Hibernation for bats begins around November, depending on the temperature. The outdoor area of the enclosure will be open to the elements, while the interior part (the bat house) will be modeling the temperature and humidity of the local cave systems. Bats do not normally hibernate in bat houses because they are usually subject to the temperature of the surrounding area. Our bat house will be temperature and humidity regulated to entice the bats into treating it like their normal hibernacula, thus allowing our scientists to observe their behavior during hibernation in a controlled environment. The bat house will also have the appearance of a cave on the inside.

The goal of the first year will be to ensure that the bats are willing to hibernate and survive within the enclosure. It has proven to be difficult to keep bats alive in captivity, so this will be the first hurdle we will have to overcome. Once we have successfully observed the bats during hibernation we will be able to introduce a new batch of bats inside the enclosure to begin testing other environmental factors that may affect the spread and/or control of WNS. The data we collect will be used to entice other labs to invest in the blueprints and create their own bat labs so that further studies can be conducted towards ending the spread of this terrible disease.

Discussion

- *Discuss the relation of the proposed project to any existing efforts.*

When looking at the spread of White Nose Syndrome, many scientists have come up with possible cures, but there isn't a bat friendly testable environment. Our proposal is to build a facility for scientists to be able to test their cures in a safe and secure environment. This environment will be able to be built by the scientists at their location so they would be able to test the bats in their area with WNS.
- *Describe what will count as evidence that objectives have been met (criteria).*

We are developing a product that will allow scientists to test many different potential cures for WNS. There are many different scientists working on coming up with solutions on how to deal with WNS. This large bat facility will meet the objectives if the environment is safe, secure and is able to test more than one cure. That allows the scientists to be able to capture bats in their area to test their cures
- *Discuss potential implications and applications of the completion of the project.*

The potential applications for our environment is a controlled setting which will be able to test various potential cures. The potential implications are scientists will be able to conduct controlled experiments that will lead to the most effective treatment of WNS.
- *Describe how the work of the project accomplished through this year of funding could be sustained or built upon.*

The project will be accomplished with a year of funding by working with architects to have scientists build their own controlled environment. During a year, there will only be one testable group during hibernation. After the facility is built, we will have to identify bats with WNS to place in our facility. The first part of the year, we have to make sure the bats are able to survive due to the change in their environment. After the bats are stable in the environment, in September/October the Bat Lab will enclose for the bats to begin to hibernate. Once, the bats are safe and secure the scientists will be able to use the aerosolizer to spray the potential cures into the enclosed Bat Lab. After the hibernating season is over, the scientists will be able to identify if the antidote was successful or not. This bat facility will be successful if the enclosure helped the scientists successfully release the potential cure into the enclosed environment and a decrease in WNS is observed. Through the educational outreach program we will increase awareness of the benefits of bats to both farming and to rural/urban neighborhoods. A fundraising component called the Save the Sky Puppies Initiative will be incorporated into the outreach program that will help to fund the project into consecutive years. Farmers will be offered bat-house building services which they can purchase, donate, or buy blueprints which they can use to build their own bat houses on their farmlands.

Budget

Items	# of items	Cost per item	Total cost
Wood for bat house	1 blueprint (from an existing design)	\$50,000	50,000
Architect	1	3,000	3,000
Construction	5	400 per day (10 days)	4,000
Bat netting for enclosure	30'X30'	\$42.00 per 10'X14'	37,800
Aerosolizer system for bat house	1	\$500	500
Plants for enclosure	30	\$15	450
Cave rocks	15	\$10	150
Wooden beams (4X4)	8	\$77	616
Grad students	2	\$20,000	40,000
Enclosure upkeep	2 (employees)	\$35,000	70,000
Temperature regulation system	1	\$32	32
1 ES and 1 HS teacher - Consulting	2 teachers	\$5,000	10,000
Bat scientists	1	\$30,000	30,000
Licenses	2	\$10	20
Thermal imaging cameras	2	\$500	1000
Total overall cost			\$247,568

Bibliography

Boyles, J. G., & Willis, C. K. (2010). Could localized warm areas inside cold caves reduce mortality of hibernating bats affected by white-nose syndrome?. *Frontiers in Ecology and the Environment*, 8(2), 92-98.

Rocke, T.E., Kingstad-Bakke, B., Wüthrich, M. *et al.* Virally-vectored vaccine candidates against white-nose syndrome induce anti-fungal immune response in little brown bats (*Myotis lucifugus*). *Sci Rep* 9, 6788 (2019). <https://doi.org/10.1038/s41598-019-43210-w>

White-Nose Syndrome (WNS). (2017) National Wildlife Health Center. URL https://www.nwhc.usgs.gov/disease_information/white-nose_syndrome/ [accessed February 2018]