Implementation of
The National Plan for Assisting States, Federal Agencies, and Tribes in Managing White-Nose Syndrome in Bats

1.22.2014

Introduction

White-nose syndrome (WNS) is a disease responsible for unprecedented mortality in hibernating bats in the northeastern U.S. Best estimates indicate losses of more than 5.5 million bats by 2013 and many states report population losses exceeding 90 percent at affected sites. This disease has spread rapidly since its discovery in January 2007 and poses a significant threat to hibernating bats throughout North America. As of May 2013, we have confirmed WNS in seven species: big brown bat (*Eptesicus fuscus*), eastern small-footed bat (*Myotis leibii*), little brown bat (*M. lucifugus*), northern long-eared bat (*M. septentrionalis*), Indiana bat (*M. sodalis*), gray bat (*M. grisescens*) and tricolored bat (*Perimyotis subflavus*). Rates of mortality differ among species, the reason for which remains unknown. We have also found evidence of the fungus that causes WNS, *Pseudogymnoascus destructans* (formerly *Geomyces destructans*), from three more species: Virginia big-eared bat (*Corynorhinus townsendii virginianus*), southeastern bat (*M. austroriparius*) and cave bat (*M. velifer*), but no histological evidence of tissue damage or other signs of the disease have been observed in these species. As WNS spreads, challenges of understanding and managing the disease continue to increase, requiring a highly coordinated effort among state, federal, and tribal wildlife agencies and private partners to respond effectively to WNS and conserve native bat species.

National Plan

This document, *Implementation of the National Plan for Assisting States, Federal Agencies, and Tribes*, is the action plan for *A National Plan for Assisting States, Federal Agencies, and Tribes in Managing White-Nose Syndrome in Bats* ("*national WNS plan*"), released in 2011. The national WNS plan built the framework for coordination of agency and partner efforts to respond to WNS. It identified seven elements critical to the investigation and management of the disease: communications and outreach, data and technical information management, diagnostics, disease management, epidemiological and ecological research, disease surveillance and conservation and recovery. It described goals, objectives and general action items of the working groups established to address each element.

Collectively the objectives and actions identified in the national WNS plan address the greatest needs and knowledge gaps that must be pursued to manage this new disease. As such, they reflected a scientific approach solidly based in research. Because the national WNS plan was a strategic document, it did not include organizational details and information necessary to act on the objectives identified by the working groups or to guide interactions among parties contributing to the national response.

This implementation plan, which includes a section for each of the national working groups, documents the details necessary to carry out the national WNS plan and act on the goals and objectives of the individual working groups. Unlike the national WNS plan, this plan is intended to be adaptive, e.g., updated as appropriate to reflect changes in priorities for research and management.

Organizational Structure

Implementation of the national plan requires a concerted effort and commitment from many agencies and organizations to bring all parties together under a single organization. Effective implementation of a

plan as comprehensive as the national WNS plan requires action at several levels, including oversight and support at multiple levels of government. Because WNS impacts several endangered bat species and may lead to additional listings, the organized response has been developed as a single-issue recovery team by the U.S. Fish and Wildlife Service (USFWS)[1]. The recovery team is comprised of the seven working groups of the national WNS plan (mostly, biologists, researchers and other professionals who have expertise in their group disciplines), plus three oversight committees. Each working group and oversight committee has a charter that defines membership and responsibilities.

Oversight committees include a Coordination Team, a Steering Committee, and an Executive Committee (Fig. 1). The Coordination Team includes leaders of each working group, the national WNS coordinator, and additional designees of the Steering Committee. It guides actions across all working groups, works to prioritize research and conservation actions and provides recommendations to the Steering Committee.

The Steering Committee is composed of lead policy personnel from state, federal, and tribal resource management agencies and provides guidance to implement the national plan, specifically for decisions about resource allocation, management, and policy.

The Executive Committee ensures that affected state, federal, and tribal governments coordinate and collaborate at the highest levels on significant issues and response efforts related to WNS. Executive Committee members also help address WNS-related resource needs within their organization and ensure appropriate representation on all components of the WNS organizational structure, as needed.

Two additional groups help with the national response to WNS, a Technical Review Team and a Stakeholder Committee. Both of these groups interact directly with the Coordination Team and the chair of that team, the National WNS Coordinator. The Technical Review Team will come together as needed to review and assess plans, protocols and proposals. The Stakeholder Committee provides diverse, representative, organization-level stakeholder input to the WNS Coordination Team and Steering Committee. It is composed of representatives from non-governmental organizations that the

[1] White-nose syndrome has been confirmed in two federally listed bat species, Indiana bat and gray bat, and currently poses a potential risk to two additional listed bats, the Virginia big-eared bat and the Ozark big-eared bat (*C. t. ingens*). Concern over population declines resulting from WNS led the USFWS to initiate status assessments for three additional bat species: eastern small-footed bat, northern long-eared bat, and little brown bat, and on 2 October 2013 the USFWS announced a proposal to list the northern long-eared bat (findings anticipated in 2014 for little brown bat). Because WNS impacts multiple endangered bat species, the USFWS has established a single-issue recovery team, encompassing the national response structure, with participants appointed pursuant to the Endangered Species Act (ESA). The central purpose of the team is to assist the USFWS, which is responsible for administering the ESA, in effectively and efficiently advancing the recovery of endangered bat species affected by WNS. Because many species of hibernating bats interact, have similar physiological and life history traits, and colocate in caves and mines in winter, it is important to note that WNS-related research and activities involving non-listed hibernating species are intimately linked to the recovery of listed bats. Therefore, it is appropriate for the WNS Recovery Team to address interests and concerns of non-listed and listed bat species alike.

Steering Committee has identified as having an interest in bat conservation and research, ecological services of bats, wildlife disease issues and/or natural resource management pertinent to this issue. The Stakeholder Committee also has a charter that defines membership and responsibilities.

Working Group Plans

This implementation plan includes discrete plans for each of the seven working groups. Because of its adaptive nature, all or parts of this plan will be updated on an annual basis or as appropriate. Implementation strategies of the working groups will be posted on the national WNS website (http://www.WhiteNoseSyndrome.org), where specific group guidance, protocols and reports will also be posted and updated. Guidance resulting from the efforts of the working groups is intended for use by state, federal, and tribal natural resource agencies, non-government organizations and/or the public. It will be based on best available information and expert opinion of the working groups. Agencies and others can use the working group plans to identify activities relevant to their individual missions, and to facilitate partnerships and cost sharing.

The initial version of the national WNS implementation plan was reviewed and approved by the WNS Steering and Executive Committees; however, approval by those committees does not imply agency or organizational commitment of resources to address the actions identified in the plan. Likewise, the estimates presented for the cost of action items, both monetary and in staff hours, are the best estimates of the members of the individual working groups, and their inclusion in the implementation plan does not convey or imply endorsement by any government agency or organization.

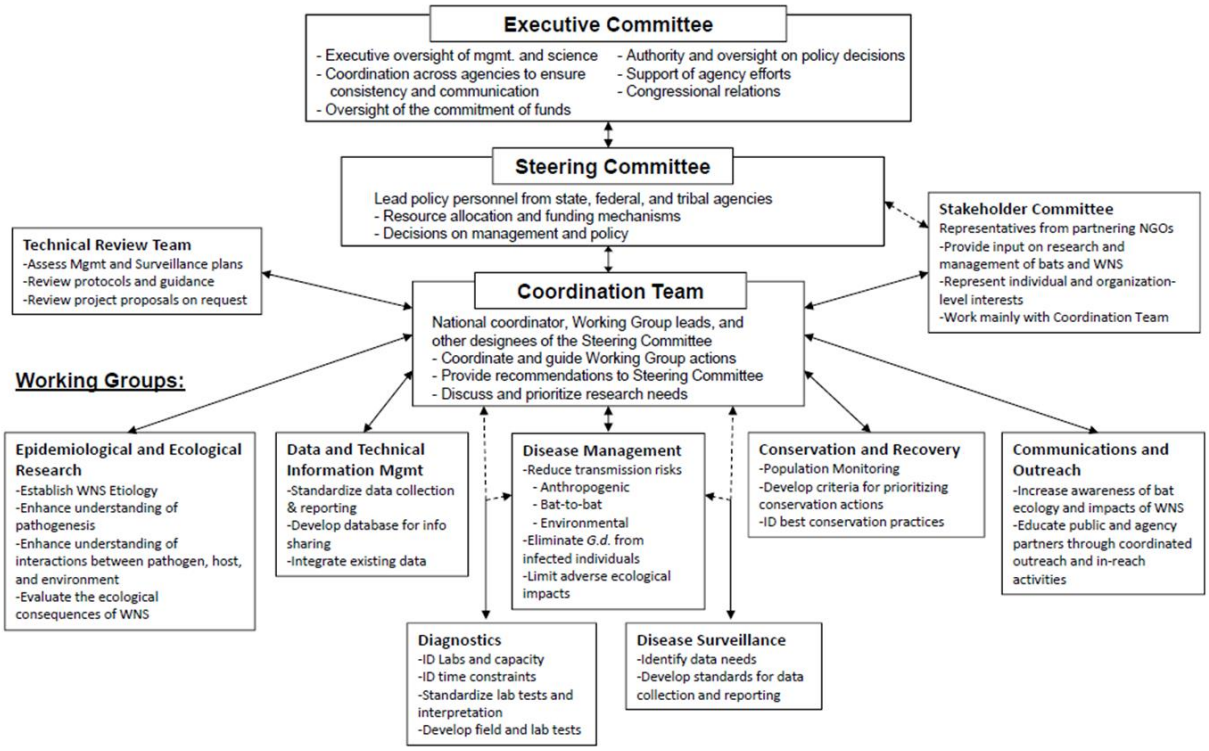

Figure 1. Organizational structure for the white-nose syndrome response under the national response plan, *A National Plan for Assisting States, Federal Agencies, and Tribes in Managing White-Nose Syndrome in Bats*, May 2011.

Communications and Outreach Implementation Plan for The National Plan for Assisting States, Federal Agencies, and Tribes in Managing White-Nose Syndrome in Bats

2011-2015

Submitted by: _____ Date: _____
Catherine Hibbard, USFWS
Communications Working Group Leader

Approved by: _____ Date: _____
Jeremy Coleman, USFWS
National White-nose Syndrome Coordinator

TABLE OF CONTENTS

EXECUTIVE SUMMARY

The *National Plan for Assisting States, Federal Agencies, and Tribes in Managing White-Nose Syndrome in Bats* (*National WNS Plan)* provides a strategic framework for the investigation and management of WNS, including key action items and the role(s) of agencies and entities involved in the continental effort.

The *National WNS Plan* recognizes that a rapid and integrated internal and external flow of information is critical to addressing White-nose Syndrome (WNS). The goal of this *Communications and Outreach Plan* is to ensure key audiences receive and understand information about WNS in a timely manner. The plan will be periodically updated to address new information about WNS and to respond to changing communications needs. The *Communications and Outreach Plan* will be carried out by various agencies and non-governmental organizations.

LIST OF PREPARERS

The following people helped to develop this *Communications and Outreach Plan* between March and August 2012:

Paula Bauer, National Park Service
Emily Preston, New Hampshire Fish and Game Department
James Eggers, Bat Conservation International
Ann Froschauer, U. S. Fish and Wildlife Service
Sandy Frost, U.S.D.A. Forest Service
Dianne Joop, National Cave and Karst Research Institute
Donna Hummel, Bureau of Land Management
Catherine Puckett, U. S. Geological Survey
Angie McIntire, Arizona Department of Fish and Game
Noelle Rayman, U. S. Fish and Wildlife Service
Gail Moede Rogall, U. S. Geological Survey
Cynthia Sandeno, U.S.D.A. Forest Service
Paul Slota, U.S. Geological Survey
Carol Zokaites, Virginia Department of Conservation and Recreation

COMMUNICATION STRATEGY

WORKING GROUP ROLES AND RESPONSIBILITIES

The Communications Working Group is responsible for developing and implementing an effective plan for communicating information about WNS to partners involved in the WNS investigation and to the public. The members of the working group and their contact information are in Appendix 1.

KEY AUDIENCES

Communication efforts are intended to disseminate information about WNS and affected bat populations to three broad audiences:

A. WNS Investigative Team, including federal and state agencies, tribes, international government partners and cooperating non-government research scientists and institutions who are directly involved with WNS research, monitoring, surveillance, management, and communications.

B. Internal audiences, including employees of federal and state agencies, tribes and international government partners not directly involved with the WNS investigation.

C. External audiences, including non-governmental research scientists and institutions, non-governmental organizations, elected officials, decision-makers, news media and the public.

ACTION PLAN

Four strategic goals, along with several action items, were identified in the *National WNS Plan* to foster proactive communication among the WNS Investigative Team, other partner employees and the public. These goals and action items were used as the starting point for the Action Plan in this *Communications and Outreach Plan.*

Goal 1: Communicate research, monitoring, surveillance, management and communication activities among the WNS investigative team to facilitate an effective response to WNS.

Action Items:

1. Finalize an organizational chart to ensure that coordination and flow of communication are clearly defined among the WNS investigative team.
2. Designate points of contact for each working group identified in the organizational chart to work with the WNS investigative team on a broad range of communications issues, including when and how proprietary data would be shared among team members.
3. Develop a communications toolbox for the WNS investigative team.
4. Communicate about activities and distribute products to the WNS investigative team in a timely manner.

Goal 2: Communicate about WNS as an unprecedented wildlife disease event resulting in devastating consequences, spreading at an alarming rate and with no obvious means of curtailment.

Action Items:

1. Disseminate information that is responsive to a broad range of frequently asked questions regarding WNS.
2. Create, deliver and update products that can be customized to convey key information about WNS.
3. Develop and disseminate communications tools, specific messages and products for internal and external audiences, as needed.

Goal 3: Communicate about the importance of bats to people, ecosystems, biodiversity and economies.

Action Items:

1. Disseminate information that is responsive to a broad range of frequently asked questions regarding the importance of bats.
2. Create, deliver and update products that can be customized to convey the key information about the importance of bats.

Goal 4: Communicate about the efforts of the partner agencies and organizations involved in the WNS investigation to control and manage WNS.

Action Items:

1. Disseminate information that is responsive to a broad range of frequently asked questions about the collaborative effort to control and manage WNS.
2. Create, deliver and update products that can be customized to convey key information about the collaborative effort to control and manage WNS.
3. Distribute the recommended practices and procedures to minimize the spread of WNS to all audiences.
4. Publish contact information for key WNS investigation team members and State/Federal WNS points of contact.

Action items were identified with some detail and then prioritized**. A working group member is identified as the lead to ensure the action is carried out or adjusted as needed.

***For purposes of the Action Plan, Version 12.6.2010, the writing team agreed to focus on items with a priority rank of 1, 2 or 3. These are foundational pieces to the working group and to the WNS investigation.*

MONITORING AND EVALUATION OF THE COMMUNICATIONS GUIDE

This *Communications and Outreach Plan* will be reviewed quarterly by the Communications Working Group (March, June, September and December) and updated as needed.

The Communications Working Group leader will assemble the working group members (via conference call, videoconference, webinar or other means). Updates to the *Communications and Outreach Plan* will be forwarded to the WNS Coordinators, steering committee and other working group leaders for approval.

APPENDIX 1. COMMUNICATIONS WORKING GROUP CONTACTS

Communications and Outreach Working Group Leader
The leader is responsible for pulling the core and extended teams together, as needed, to implement, evaluate and update the *Communications and Outreach Plan*. The leader will serve with the WNS coordinators and other working group leads to provide recommendations to the steering committee and prioritize research needs.

Catherine Hibbard
National WNS Communications Leader
U. S. Fish and Wildlife Service, Region 5
300 Westgate Center Drive
Hadley, MA 01035-9589
(413) 253-8569 (office)
(413) 531-4276 (cell)
(413) 253-8456 (fax)
catherine_hibbard@fws.gov

Communications and Outreach Working Group Members

Alyssa Bennett	Vermont Fish and Wildlife Department
Emily Preston	New Hampshire Fish and Game Department
Sandy Frost	U.S. Forest Service
Dianne Joop	National Cave and Karst Research Institute
Katie Gillies	Bat Conservation International - Deputy Leader, Liaison to Conservation & Recovery WG
Joe Hoyt	University of California, Santa Cruz - Liaison to Disease Management WG
Donna Hummel	Bureau of Land Management
Dianne Joop	National Cave and Karst Research Institute
Ellen Lance	U.S. Fish and Wildlife Service
Kate Langwig	University of California, Santa Cruz - Liaison to Epidemiology and Ecology WG
Emily Linroth	National Park Service
Marisa Lubeck	U.S. Geological Survey
Gail Moede Rogall	U.S. Geological Survey - Liaison to Diagnostics WG
Kevin Olival	EcoHealth Alliance - Liaison to the Stakeholder Committee

Allysia Park	Canadian Cooperative Wildlife Health Centre, National WNS Coordinator, Canada
Tara Poloskey	Texas Parks and Wildlife Department
Noelle Rayman	U.S. Fish and Wildlife Service
Cynthia Sandeno	U.S. Forest Service
Paul Slota	U.S. Geological Survey
Carol Zokaites	Virginia Department of Conservation and Recreation

APPENDIX 2. ACTION PLAN

Key to Audience Descriptions:
A = WNS Investigation Team, B = Internal Audiences, C = External Audiences

WG Lead = Working group member designated to track status and completion of activity

Goal 1: Communicate research, monitoring, surveillance management and communication activities among the WNS investigative team to facilitate an effective response to WNS.

Action No./ Task No.	Activity	Lead	Expertise Required	Review	Relative Order	Estimated timeframe	Estimated Total Budget and Status	Funding Requested
1.1 Ensure coordination and communication flow is clearly defined among the WNS investigative team.								
1.1.1	Assist in the finalization of the National WNS Organization structure concept (Appendix 1), including roles and responsibilities of the committees, coordinators and working groups.	USFWS		Complete	1	2011	$0, Completed	0.00
1.1.2	Post the National WNS Organization Chart and its roles and responsibilities on the WNS Webpage.	USFWS		Complete	2	2011	$0, Completed	0.00
1.1.3	Develop standard practices for communicating within the WNS organization structure to facilitate connectivity between organization levels and working groups. Standard practices will address sharing information, including proprietary data.	USFWS/Catherine Hibbard		Ongoing-annual hosting/maintenance	1	Ongoing	$13,000 annually for hosting, security, maintenance	13000.00

1.1.4	Designate a Communications Working Group liaison for each WNS Organization level and working group.	USFWS/Catherine Hibbard		Complete	1	Update as needed	$0, completed	0.00
1.2 Develop a communications toolbox for the WNS investigative team.								
1.2.1	Develop a web-based sharing tool accessible for posting and retrieving information to be used in communicating with external audiences. Produce instructions for its use and make these available to the WNS Investigation Team. Individuals involved in the WNS investigation could post and share materials such as presentations, photographs, scientific literature, data, interim research reports, tools for management.	USFWS/new website		Ongoing-annual hosting/maintenance	1	2011	$0, see H6	0.00
1.2.2	Organize annual WNS planning and information sharing meeting, which also includes cooperating external audiences.	USFWS, BCI		Annual WNS Workshop, Ongoing	2	Annual	100000 (funded by USFWS, Partners)	100,000.00
1.2.3	Develop a point of contact database to include the following: federal, state and tribal WNS biologists, Congressional members, media, researchers involved in WNS research, NGOs and members of the WNS Investigation Team with media communications expertise.	USFWS website		Ongoing	2	Ongoing	$0	0.00

1.2.4	Maintain monthly federal-state-tribal agency and federal-state-tribal-stakeholder conference calls to facilitate information sharing.	USFWS/Jeremy Coleman		Ongoing	1	Ongoing	$0	0.00
1.2.5	Develop and maintain a suggestion box on the WNS website for information sharing needs and opportunities.	USFWS			3	2012	$500, not funded	500.00
1.3 Communicate about activities and distribute products to the WNS investigative team in a timely manner.								
1.3.1	Develop a protocol for updating the WNS web pages.	USFWS/Catherine Hibbard		Complete	1	2011	$0, Complete	0.00
1.3.2	Utilize the WNS website to post brief news or activity updates, such as summaries of Congressional briefings, Association of Fish and Wildlife Agencies activities or biological findings.	USFWS/Catherine Hibbard		Ongoing	1	Ongoing	$0, Ongoing	0.00
1.3.3	Support the National Speleological Society and its effort to post all media coverage pertaining to WNS on its website.	USFWS and others		Ongoing	2	Ongoing	$0, Ongoing	0.00
1.3.4	Translate and publish the National WNS Plan and Implementation Plans in Spanish and French for our international partners.				3	2012	2000	2,000.00

<u>Goal 2</u>: Communicate about WNS as an unprecedented wildlife health crisis resulting in devastating consequences, spreading at an alarming rate, and with no obvious means of curtailment.

Action No./ Task No.	Activity	Lead	Expertise Required	Review	Relative Order	Estimated timeframe	Estimated Total Budget and Status	Funding Requested
2.1 Disseminate information that is responsive to a broad range of frequently asked questions regarding WNS as a wildlife health crisis.								
2.1.1	Develop and maintain a Frequently Asked Questions section on the WNS website.	Gail Moede Rogall (USGS)		Ongoing	1	Ongoing	$0, Ongoing	0.00
2.1.2	Allow the public to post questions on the WNS website and update FAQs to address their questions.			Ongoing	3	Ongoing	$0, Ongoing	0.00
2.2 Create, deliver and update customizable products to convey key information about WNS as an unprecedented wildlife health crisis.								
2.2.1	Employ the skills of a webmaster to maintain a high quality, interactive WNS website.	USFWS		Ongoing- annual hosting/maintenance	1	2012	see H6	0.00
2.2.2	Develop a brochure that explains WNS and its significance as a wildlife crisis. Make available on the WNS website and partner websites.	USFWS/USFS Cindy Sandeno		Updated 2013	1	2011	$6000, funded (USFS); $1000 not funded	1,000.00
2.2.3	Produce WNS awareness materials for dissemination by partner agencies and organizations (e.g., bumper stickers, magnets).	USFWS		Ongoing	3	Ongoing	$5000, not funded	5,000.00
2.2.4	Post examples of federal and state WNS-related news releases on the web-based sharing tool.	USFWS/new website		Ongoing	3	2012	$0, Ongoing	0.00

2.2.5	Maintain a link from the WNS website to the USGS National Wildlife Health Center Bulletins.	USFWS/Catherine Hibbard		Complete	1	Complete	$0, Complete	0.00
2.2.6	Maintain a WNS blog on the WNS website; evaluate its use and effectiveness every six months.	USFWS/Catherine Hibbard		Ongoing	1	Ongoing	$0, Ongoing	0.00
2.2.7	Post podcasts, video clips and other media products on the WNS website, or create links to such materials.	USFWS		Ongoing	1	Ongoing	$0, Ongoing	0.00
2.2.8	Query partners for their information needs twice a year (before and after the WNS season).			Ongoing	2	Ongoing	$0, Ongoing	0.00
2.2.9	Use social media to engage citizens (e.g., blog, Twitter, Facebook).	USFWS/Catherine Hibbard		Ongoing	1	Ongoing	$0, Ongoing	0.00
2.3 Develop and disseminate communications tools, specific messages and products for internal and external audiences.								
2.3.1	Identify appropriate methodologies to inform target audiences about decontamination procedures and produce/disseminate outreach materials, such as: DVDs, brochures, wallet-sized cards, posters for visitor centers, canned presentations for grottos, info packets for grottos, web links.			Ongoing	1	Ongoing	$5000, not funded	5,000.00
2.3.2	Adopt a logo or slogan that can become the symbol for a WNS awareness campaign.			Ongoing	2	Ongoing	$0, Ongoing	0.00

2.3.3	Update "Battle for Bats" or other outreach video highlighting work of partners in WNS response for use by partners, others.	USFS/USFWS		Ongoing	1	Ongoing	$30,000, USFS committed funds ($23,500)	6,500.00

<u>Goal 3</u>: Communicate about the importance of bats to people, ecosystems, biodiversity and economies.

Action No./ Task No.	Activity	Lead	Expertise Required	Review	Relative Order	Estimated timeframe	Estimated Total Budget and Status	Funding Requested
3.1 Disseminate information that is responsive to a broad range of frequently asked questions regarding the importance of bats.								
3.1.1	Develop and maintain a Frequently Asked Questions section on the WNS website.	Gail Moede Rogall (USFWS website-Catherine Hibbard)		Ongoing	1	Ongoing	$0, Ongoing	0.00
3.1.2	Develop and maintain a "Mythbusters" section on the WNS website, and share with other bat conservation organizations.			Ongoing	1	Ongoing	$0, Ongoing	0.00
3.2 Create, deliver and update customizable products to convey the key information about the importance of bats.								
3.2.1	Develop citizen science projects.			Ongoing	3	Ongoing	$0, Ongoing	0.00
3.2.2	Educational posters.			Ongoing	3	Ongoing	$1000, Ongoing	1,000.00
3.2.3	Develop educational trunks.			Ongoing	3	Ongoing	$5000, Ongoing	5,000.00
3.2.4	Develop bat educational modules for Project Learning Tree, 4H, FFA, K-12 Coursework.			Ongoing	3	Ongoing	$0, Ongoing	0.00
3.2.5	Encourage the adoption of a "state bat".			Ongoing	3	Ongoing	$0, Ongoing	0.00
3.2.6	Encourage the establishment of a national bat day/bat awareness week.	Working with Eurobat and BatsLIVE!		Ongoing	3	Ongoing	$0, Ongoing	0.00
3.2.7	Develop a private landowner's guide to managing for bats.			Ongoing	2	Ongoing	$1000, Unfunded	1,000.00

Goal 4: Communicate about the efforts of the partner agencies and organizations involved in the WNS investigation to control and manage WNS.

Action No./ Task No.	Activity	Lead	Expertise Required	Review	Relative Order	Estimated timeframe	Estimated Total Budget and Status	Funding Requested
4.1 Disseminate information that is responsive to a broad range of frequently asked questions about the collaborative effort to control and manage WNS.								
4.1.1	Develop and maintain a Frequently Asked Questions section on the WNS website.	Gail Moede Rogall (USFWS website- Catherine Hibbard)		Ongoing	1	Ongoing	$0, Ongoing	0.00
4.2 Create, deliver and update customizable products to convey key information about the collaborative effort to control and manage WNS.								
4.2.1	Identify and categorize current and potential partner agencies and organizations.	Carol Zokaites		Ongoing	2	Ongoing	$0, Ongoing	0.00
4.2.2	Collect partner bios (mission, URL, WNS links).	USFWS- website		Ongoing	1	Ongoing	$0, Ongoing	0.00
4.2.3	Create partner profiles for the WNS website	.USFWS- website		Ongoing	1	Ongoing	$0, Ongoing	0.00
4.2.4	Identify collaborative efforts and partnerships (with input from partners identified above)	USFWS- website		Ongoing	1	Ongoing	$0, Ongoing	0.00
4.2.5	Create a rotating "Partner Profile" on the WNS website, highlighting collaboration between partners.	USFWS- website		Ongoing	1	Ongoing	$0, Ongoing	0.00

Action No./ Task No.	Activity	Lead	Expertise Required	Review	Relative Order	Estimated timeframe	Estimated Total Budget and Status	Funding Requested
4.2.6	Work with partners to create categorized (e.g., websites, news releases, fact sheets, audiovisual) inventory of existing resources and products under their management.	Catherine Hibbard/USFWS website		Ongoing	1	Ongoing	$0, Ongoing	0.00
4.2.7	Create a repository or shared resources (e.g., video, audio, photos, fact sheets) that can be used by partner organizations.			Ongoing	1	Ongoing	$0, Ongoing	0.00
4.2.8	Create "WNS Communicator's Toolkit" with region-specific content for external audiences.			Ongoing	2	Ongoing	$0, Ongoing	0.00
4.2.9	Create customizable traveling bat/WNS displays for use at events (Prototype from USFWS R5).	USFWS		Ongoing	2	2012-Northeast Regional prototype	$45,000: $10,000 funded (Northeast Regional prototype); $35,000 unfunded	35,000.00
4.3 Distribute the recommended practices and procedures to minimize the spread of WNS to all audiences.								
4.3.1	Identify appropriate methods to inform target audiences about decontamination procedures and produce/disseminate outreach materials, such as: DVDs, brochure, wallet-sized card, posters for visitor centers, canned presentations for grottos, web links.	Noelle Rayman		Ongoing	1	2012, Ongoing	$6000, Unfunded	6,000.00

4.3.2	Create website text and illustrations that can be adapted for many websites (for State and federal agencies, NGOs, caving clubs (grottos)).			Ongoing	3	Ongoing	$0, Ongoing	0.00
4.4 Publish contact information for key WNS investigation team members and State/Federal WNS points of contact.								
4.4.1	Establish and maintain a clearly identified link on the WNS website for WNS Team contact information.	USFWS/Catherine Hibbard		Ongoing	1	2012, Ongoing	$0, Ongoing	0.00
4.4.2	Post the WNS team organization chart on the contact webpage and link contact information to each coordinator and working group lead found on the chart.	USFWS/Catherine Hibbard		Ongoing	2	2012, Ongoing	$0, Ongoing	0.00
4.4.3	Develop and maintain contact lists for each of the federal and state agencies involved in the WNS investigation; link this information on the contact webpage.	USFWS/Catherine Hibbard		Ongoing- new website	1	Ongoing	$0, Ongoing	0.00
4.4.4	Call for updates to the state-federal contact lists quarterly.	USFWS		Ongoing- new website	2	Ongoing	$0, Ongoing	0.00

APPENDIX 3. BUDGET SUMMARY BY GOAL

WNS National Plan Goal		Year					
		2011	**2012**	**2013**	**2014**	**2015**	**Total**
Communicate research, monitoring, surveillance, management and communication activities among the WNS investigative team to facilitate an effective response to WNS.	Staff Time (Hours)	500	500	500	500	500	2500
	Budget (Dollars)	128,500	115,500	105,000	105,000	105,000	559,000
Communicate about WNS as an unprecedented wildlife health crisis resulting in devastating consequences, spreading at an alarming rate, and with no obvious means of curtailment.	Staff Time (Hours)	200	300	300	300	300	1400
	Budget (Dollars)	17,500	17,500	17,500	17,500	17,500	87,500
Communicate about the importance of bats to people, e cosystems, biodiversity, and economies.	Staff Time (Hours)	200	300	300	300	300	1400
	Budget (Dollars)	3,000	7,000	7,000	7,000	7,000	31,000
Communicate about the efforts of the partner agencies and organizations involved in the WNS investigation to control and manage WNS.	Staff Time (Hours)	200	200	200	200	200	1000
	Budget (Dollars)	16,000	41,000	11,000	11,000	11,000	90,000
Total	Staff Time (Hours)	1100	1300	1300	1300	1300	6300
	Budget (Dollars)	165,000	181,000	140,500	140,500	140,500	767,500

APPENDIX 4. CURRENT ACTION PRIORITIES – V.12.2.2013

- Develop and maintain messaging to tell what we are doing for WNS and what the public can do
- Develop and maintain messaging about the story of bat conservation and what we can do for bats. Need to keep focus on conservation and generating support for bats, and override the sense of futility surrounding WNS.
- Update the "Battle for Bats" brochure that explains WNS and its significance as a wildlife crisis. Make available on the WNS website and partner websites
- Update "Battle for Bats" or other outreach video highlighting work of partners in WNS response for use by partners, others
- Update educational resources on website. Currently, the page (http://whitenosesyndrome.org/resources/education) has mostly newsletters and press releases at the top. Need to make more user-friendly.
- Create a repository for shared resources (e.g., video, audio, photos, fact sheets) that can be used by partner organizations
- Develop and maintain a Frequently Asked Questions section on the WNS website.
- Identify appropriate methodologies to inform target audiences about decontamination procedures and produce/disseminate outreach materials, such as: DVDs, Brochures, Wallet-sized card, Posters for Visitor Centers, Canned Presentations for Grottos, Info Packets for Grottos, Web links
- Develop and maintain contact lists for each of the federal and state agencies involved in the WNS investigation; link this information on the Contact webpage
- Update Communications Plan
- Develop "The Ask." What do we want the public to do? Agencies? Etc.?
- Update the Point of Contact database to include the following: federal, state, and tribal WNS biologists, Congressional members, media, researchers involved in WNS research, NGOs, and members of the WNS Investigation Team with media communications expertise.
- Develop Educational Posters
- Develop two downloadable educational activities/modules on the value of bats and what their loss could mean due to WNS. Have all needed items uploaded to website for partners (http://whitenosesyndrome.org/resources/education). In future, adapt activities for Project Learning Tree, 4H, FFA, K-12 coursework.
- Develop a Private Landowners Guide to Managing for Bats
- Create “WNS Communicator’s Toolkit” with region-specific content for external audiences
- Post the WNS Team Organization Chart on the Contact webpage, and link contact information to each coordinator and working group lead found on the chart
- Messaging for employees/concessionaires on what to say about WNS
- Develop new partnerships with the agricultural and garden community to tell the story of the importance of bats.

- Post podcasts, video clips, and other media products on the WNS website, or create links to such materials.
- Presence at National Speleological Society conference. Could include postcards reminding folks from West not to bring gear to infected states, display at convention, etc.
- BatsLIVE! webinar on WNS
- Develop "Press Kits" for working with local media.
- Write article on WNS for national interpretation association
- Develop umbrella logo to symbolize the partnerships developed to fight WNS.
- Produce WNS awareness materials (giveaways) for dissemination by partner agencies and organizations (e.g., bumper stickers, magnets). Add link to WNS web page.
- Develop Educational Trunks
- Allow the public to post questions on the WNS website and update FAQs to address their questions.
- Adopt a logo or slogan that can become the symbol for a WNS Awareness Campaign
- Encourage the establishment of a national bat day/bat awareness week
- Provide information about WNS for the "Masters of the Night" exhibit
- Create customizable traveling bat/WNS displays for use at events (Prototype from USFWS R5)
- Develop and maintain a “Mythbusters” section on the WNS website, and share with other bat conservation organizations
- Translate and publish the National WNS Plan and Implementation Plans in Spanish and French for our international partners
- Create a rotating “Partner Profile” on the WNS website, highlighting collaboration between partners
- Encourage the adoption of a “state bat”

Data and Technical Information Management for The National Plan for Assisting States, Federal Agencies, and Tribes in Managing White-Nose Syndrome in Bats

2011-2015

Submitted by: _____ Date: _____
Laura E. Ellison, USGS
Data and Technical Information Management Working Group Leader

Approved by: _____ Date: _____
Jeremy Coleman, USFWS
National White-nose Syndrome Coordinator

TABLE OF CONTENTS

EXECUTIVE SUMMARY

The *National Plan for Assisting States, Federal Agencies, and Tribes in Managing White-Nose Syndrome in Bats* (*National WNS Plan)* provides a strategic framework for the investigation and management of white-nose syndrome (WNS), including key action items and the role(s) of agencies and entities involved in the continental effort. It establishes seven critical elements as working groups, which include Data and Technical Information Management, and identifies the major goals and key action items within each of these elements to embark on a collaborative, continental effort to address this emerging infectious disease of North American bats.

The *National WNS Plan* recognizes that the management and dissemination of scientific information is critical to States, Federal agencies, Tribes, and other groups involved in the investigation and management of WNS. The goal of this *Data and Technical Information Management Plan*, "*Data Management Plan*," is to identify and assign specific tasks necessary to achieve each Action Item outlined in the Data Management section of the *National WNS Plan*. This document is meant to be an adaptive product that will be periodically reviewed and updated by members of the Data Management Working Group to incorporate advancements made in data management and web-based applications so that information can by rapidly disseminated to the scientific community working on WNS-based issues.

LIST OF PREPARERS

The following people helped to develop this *Data Management Plan,* from February through August 2012:

Laura E. Ellison, U.S. Geological Survey
Paul Cryan, U. S. Geological Survey
Joy O'Keefe, Indiana State University
Richard Truex, U.S. Forest Service
Joshua Dein, U.S. Geological Survey
Lance Everette, U.S. Geological Survey
Jeremy Coleman, U.S. Fish and Wildlife Service
Susan Loeb, U.S. Forest Service
Kevin Castle, National Park Service

DATA MANAGEMENT STRATEGY

WORKING GROUP ROLES AND RESPONSIBILITIES

The Data Management Working Group is responsible for developing and implementing an effective plan for creating uniform standards for data collection and data transfer to help

facilitate research and management of WNS. The members of the working group and their contact information are provided in Appendix 1. These individuals will serve as a team to oversee the implementation of this plan. The working group will convene periodically to review and report accomplishments and prioritize future efforts.

DATA MANAGEMENT ACTIVITY SCHEDULE

Two strategic goals, along with several action items, were identified in the *National WNS Plan.* These goals and action items were used as the starting point for developing and prioritizing the Data Management Activity Schedule (see Appendix 2).

MONITORING AND EVALUATION OF THE DATA MANAGEMENT GUIDE

This Data Management Plan will be reviewed twice a year by the Data Working Group (April and October) and updated as needed.

The Data Management Working Group leader will assemble the working group members (via conference call, videoconference, webinar, or other means). Updates to the *Data Management Plan* will be forwarded to the WNS Coordinators, Steering Committee, and other working group leaders for approval.

APPENDIX 1. DATA MANAGEMENT WORKING GROUP CONTACTS

Data Management Working Group Leader
The leader is responsible for pulling the core and extended teams together, as needed, to implement, evaluate, and update the *Data Management Plan*. The leader will serve with the WNS coordinators and other working group leads to provide recommendations to the steering committee and prioritize research needs.

Data Working Group Core Team
The core team is comprised of representatives from some of the agencies and organizations involved in the WNS investigation.

Paul Cryan, USGS Fort Collins Science Center 2150 Centre Ave., Bldg. C Fort Collins, CO 80526 (970) 226-9389 (office) cryanp@usgs.gov	**Joshua Dein, USGS** National Wildlife Health Center 6006 Schroeder Road Madison, WI 53711-6223 (608) 270-2450 fjdein@usgs.gov	**Lance Everette, USGS** Fort Collins Science Center 2150 Centre Ave., Bldg. C Fort Collins, CO 80526 (970) 226-9225 everettel@usgs.gov

Richard Truex, USFS Rocky Mountain Region 740 Simms St. Golden, CO 80401 (303) 275-5022 rtruex@fs.fed.us	**Joy O'Keefe, Indiana State University** Department of Biology Indiana State University joyokeefe@gmail.com	**Susan Loeb, USFS** Southern Research Station Department of Forestry & Natural Resources Clemson University Clemson, SC 29634 PH: 864-656-4865, Fax: 864-656-1407 E-mail: sloeb@clemson.edu or sloeb@fs.fed.us
Kevin Castle, NPS Wildlife Health Branch National Park Service 1201 Oakridge Drive, Suite 200 Fort Collins, CO 80525 Cell: (970) 219-0104 Phone: (970) 267-2162 Kevin_Castle@nps.gov	**Jeremy Coleman, USFWS** National WNS Coordinator Wildlife Disease Coordinator, NE Region 300 Westgate Center Drive Hadley, Massachusetts 01035 USA office: 413.253.8223 mobile: 413.265.1441 jeremy_coleman@fws.gov	**Sybill Amelon, USFS** National R&D Coordinator - WNS USFS Northern Research Station 202 Nat. Res. Bldg. - Univ. of Mo. Columbia, MO 65211 573-875-5341 ext. 231 e-mail samelon@fs.fed.us
Thomas Rodhouse, NPS Upper Columbia Basin Network I&M 63095 Deschutes Market Road Bend, OR 97701 (541) 312-6425 Tom_Rodhouse@nps.gov	**Kristine Evans, USFWS** National Wildlife Refuge System Gulf Coastal Plains and Ozarks Inventory and Monitoring Network Box 9627, Mississippi State, MS 39762 (662) 325-7642 Kristine_Evans@fws.gov	**Jenny Barnett, USFWS** Mid-Columbia River NWRC 64 Maple Street Burbank, WA 99323 509-380-6479 Jenny_Barnett@fws.gov

APPENDIX 2. DATA MANAGEMENT ACTIVITY SCHEDULE, 2011-2015

The following tables highlight activities necessary for implementing a data management scheme to monitor, conserve and recover species affected by or susceptible to WNS for the period 2011-2015. Estimates for timeframes and budgets will be reviewed annually and updated.

Goal 1: Provide a database system that can be used by all state, federal and tribal agencies, and serve as a central repository for nationwide analyses and specific projects. Staff Time ~480 h, annually.

Action No./ Task No.	Activity	Lead	Expertise Required	Review	Relative Order	Estimated Timeframe	Estimated Total Budget and Status	In Progress
Action Item 1.1: Establish or utilize an existing robust database that can accommodate diagnostic test results as well as monitoring and surveillance data from state, federal and tribal agencies.								
1.1.1	Develop a *WNS Disease Tracking System v. 1.0.*	Cryan/Everette	Data WG, USGS	Initial review completed by NY, PA, and VT state points of contact.	1st	Completed: 12/2011	$75,000 ($60,000 from QRP, $15,000 from FORT), Staff Time, **Completed**	Completed; NY, PA, VT users QA/QC'ing data. Working with UC Santa Barbara (W. Frick) to incorporate 17 new state's 800 samples.
1.1.2	Develop a *WNS Disease Tracking System v. 2* based on feedback from state POCs on *v. 1.*	Everette/Ellison/ Cryan	Data WG, USGS	Updated frequently	2nd	TBD: funding dependent FY13	$280,000 (all staff time, project manager and developer); Not funded	Initial Scoping/Planning

Action No./ Task No.	Activity	Lead	Expertise Required	Review	Relative Order	Estimated Timeframe	Estimated Total Budget and Status	In Progress
1.1.3	Enhance the *USGS Bat Population Data (BPD) Project* to *v. 2* with help of other working groups and the WNS Population Modeling and Monitoring Workshop.	Ellison/Everette	Data WG, USGS, USFWS, NPS, USFS	Updated frequently	2nd	Scheduled Completion: 10/1/2012	$56,000, In Progress, FUNDED (USGS-FORT)	In Progress: Bibliographic search June 2012; count/roost data July 2012; and capture data August 2012
1.1.4	Based on feedback from *BPD* v. 2, increase the capabilities to provide a framework for national modeling and monitoring of bat populations on a national scale (*Bat Population Database Project v. 3*).	Ellison/Everette/ Castle	Data WG, USGS, NPS, USFWS	Updated quarterly	3rd	TBD: funding dependent FY14	$220,000; Not funded	Planned. Will be based on prioritized *BPD v. 2* user feedback and data management team needs. Will incorporate acoustic data and analyses.

Action No./ Task No.	Activity	Lead	Expertise Required	Review	Relative Order	Estimated Timeframe	Estimated Total Budget and Status	In Progress
Action Item 1.2: Develop a data import system to allow State and Federal agencies to enter their current and archival data.								
1.2.1	Develop data import systems for bibliographic citations, count/roost data, capture data, and acoustic data with improvements to the existing *BPD v.2.*	Ellison/Everette	Data WG, USGS	Updated quarterly	1st	FY12-FY14	$10,000, part of lump sum in 1.1.2 & 1.1.4, Staff Time	In Progress (*BPD v. 2*)
Action Item 1.3: Develop data collection and management standards in cooperation through laboratory testing.								
1.3.1	*WNS v. 1 & 2.* Coordinate with laboratories and the Diagnostic Working Group to develop data collection and management standards.	Ellison/Everette	Data WG, Diagnostics WG, USGS	Updated quarterly	1st	FY13-FY14	$16,000, part of budget in 1.1.2 & 1.1.4, Staff Time	In progress (*WNS Disease Tracking System v. 1 & 2*)

Action No./ Task No.	Activity	Lead	Expertise Required	Review	Relative Order	Estimated Timeframe	Estimated Total Budget and Status	In Progress
Action Item 1.4: Develop a certification and quality control system.								
1.4.1	Build certification and quality controls into both the *WNS Disease Tracking System v. 1* and *2* and the *BPD v. 2* and *3* projects.	Ellison/Everette	Data WG, USGS	Updated quarterly	1st	2013	Staff Time	In progress (WNS Disease Tracking System v. 1 & 2 BPD Project v. 2 & 3)
Action Item 1.5: Provide States with a system for tracking WNS samples from collection through laboratory testing.								
1.5.1	*WNS Disease Tracking System v. 1 & 2* (see Action Item 1.1).	Ellison/Everette	Data WG, USGS	Updated quarterly	1st	2012	Part of budget in 1.1.2 & 1.1.4, Staff Time	In progress (WNS Disease Tracking System v. 1 & 2)

Action No./ Task No.	Activity	Lead	Expertise Required	Review	Relative Order	Estimated Timeframe	Estimated Total Budget and Status	In Progress
Action Item 1.6: Create data-sharing agreements that will allow inter-operability with existing WNS data and among stakeholders, while providing confidentiality of data to data providers as needed.								
1.6.1	Data-sharing and partnership agreements will be incorporated into *WNS Disease Tracking System* and the *BPD* projects.	Ellison/Everette	Data WG, USGS, NPS, USFWS	Updated quarterly	1st	2012	Part of budget in 1.1.2 & 1.1.4; Staff Time	In progress (*WNS Disease Tracking System v. 1 & 2* and *BPD Project v. 2 & 3*)

Goal 2: Integrate WNS data from state, tribal and federal agencies, land managers and other sources into a centralized system. Staff Time ~300 h, annually. Estimated $10,000-$20,000 for maintaining website annually.

Action No./ Task No.	Activity	Lead	Expertise Required	Review	Relative Order	Estimated Timeframe	Estimated Total Budget and Status	In Progress
Action Item 2.1: Conduct a thorough literature review focusing on WNS.								
2.1.1	Conduct a literature search for white-nose syndrome.	Coleman/ Cryan	Communications WG, Data WG, USFWS, USGS	Update quarterly	1st	Ongoing	Staff Time	In progress
2.1.2	Organize literature into a reference database manager. Will also be incorporating web-based bibliographic management and search capabilities in the *BPD v. 2.*	Coleman/ Cryan/Everette/Ellison	Communications WG, Data WG, USFWS, USGS	Updated quarterly	2nd	Ongoing	Staff Time	In progress
Action Item 2.2: Assemble information on biology and management of bats and other wildlife species at risk for developing WNS.								
2.2.1	See Communications Goals 1 & 2.	USFWS, whitenosesyndrome.org	Communications WG, Data WG, USFWS, USGS	Update quarterly	1st	Ongoing	Staff Time	Ongoing

Action No./ Task No.	Activity	Lead	Expertise Required	Review	Relative Order	Estimated Timeframe	Estimated Total Budget and Status	In Progress
Action Item 2.3: Collect and assemble state, federal and other pertinent bat and WNS-related data.								
2.3.1	See Communications Goals 1 & 2.	USFWS, whitenosesyndrome.org	Communications WG, Data WG, USFWS, USGS	Update quarterly	1st	Ongoing	Staff Time	Ongoing
Action Item 2.4: Create a Web-based system that will integrate information collected above.								
2.4.1	See Communications Goals 1 & 2; specifically 1.2.1 "Develop a web-based sharing tool accessible for posting and retrieving information to be used in communicating with external audiences. Produce instructions for its use and make these available to the WNS Investigation Team. Individuals involved in the WNS investigation could post and share materials such as presentations, photographs, scientific literature, data, interim research reports, tools for management."	USFWS, whitenosesyndrome.org	Communications WG, Data WG, USFWS, USGS	Update quarterly	1st	Ongoing	Staff Time	**Completed**

Action No./ Task No.	Activity	Lead	Expertise Required	Review	Relative Order	Estimated Timeframe	Estimated Total Budget and Status	In Progress
Action Item 2.5: Catalog and provide internet links to WNS information resources maintained by Federal, State, and non-government organizations, including scientific libraries.								
2.5.1	See Communications Goals 1, 2, and 4.	USFWS, whitenose syndrome. org	Communications WG, Data WG, USFWS, USGS	Update quarterly	1st	Ongoing	Staff Time	Ongoing

APPENDIX 3. BUDGET SUMMARY BY GOAL

WNS National Plan Goal		Year					
		2011	**2012**	**2013**	**2014**	**2015**	**Total**
Provide a database system that can be used by all state, federal and tribal agencies, and serve as a central repository for nationwide analyses and specific projects.	Staff Time (Hours)	0	480	480	480	480	1,920
	Budget (Dollars)	$75,000	$56,000	$280,000	$220,000	$10,000-$20,000	$641,000-$651,000
Integrate WNS data from State, Tribal, and Federal agencies, land managers, and other sources into a centralized system.	Staff Time (Hours)	0	0	300	300	300	900
	Budget (Dollars)	0	0	$10,000-$20,000	$10,000-$20,000	$10,000-$20,000	$30,000-$60,000
Total	Staff Time (Hours)	0	480	780	780	780	2820
	Budget (Dollars)	$75,000	$56,000	$290,000-$300,000	$230,000-$240,000	$20,000-$40,000	$671,000-$711,000

White-nose Syndrome Diagnostic Implementation Plan

for

The National Plan for Assisting States, Federal Agencies, and Tribes in Managing White-Nose Syndrome in Bats

2011-2015

Submitted by: _____ Date: _____
Anne Ballmann, USGS
Diagnostic Working Group Leader

Approved by: _____ Date: _____
Jeremy Coleman, USFWS
National White-nose Syndrome Coordinator

TABLE OF CONTENTS

EXECUTIVE SUMMARY

The *National Plan for Assisting States, Federal Agencies and Tribes in Managing White-Nose Syndrome in Bats* (*National WNS Plan)* provides a strategic framework for the investigation and management of WNS. It establishes seven critical elements as working groups, which includes Diagnostics, and identifies the major goals and key action items within each of these elements to embark on a collaborative, continental effort to address this emerging infectious disease of North American cave bats.

The *National WNS Plan* recognizes the need for accurate, comparable, and timely diagnosis of WNS in bats and detection of the causative agent, *Pseudogymnoascus destructans*, in environmental reservoirs as foundational for sound, effective disease management decisions by resource managers. This necessitates the development of consensus standards for diagnostic assay performance and interpretation as well as ensuring adequate lab capacity to meet the diagnostic and research needs of users. The purpose of this *WNS Diagnostic Implementation Plan* is to identify and assign specific tasks to achieve each Action Item outlined in the Diagnostic section of the *National WNS Plan*. This is meant to be an adaptive document that will be periodically reviewed and updated by members of the Diagnostic Working Group to incorporate anticipated advancements made in sampling methods and/or diagnostic techniques for rapid dissemination among field biologists and WNS diagnostic laboratories.

LIST OF PREPARERS

The following people served on the Diagnostic Working Group writing team to develop this *WNS Diagnostic Implementation Plan* between May 2010 and September 2011:

Anne Ballmann, USGS National Wildlife Health Center
M. Kevin Keel, Southeastern Cooperative Wildlife Disease Study
Elizabeth Buckles, Animal Health Diagnostic Lab Cornell University
Carol U. Meteyer, USGS National Wildlife Health Center
David Blehert, USGS National Wildlife Health Center
Terry Spraker, Colorado State University Veterinary Diagnostic Lab
Ian Barker, Canadian Cooperative Wildlife Health Centre (adjunct)

DIAGNOSTIC STRATEGY

WORKING GROUP ROLES AND RESPONSIBILITIES

The Diagnostic Working Group is responsible for establishing standards to ensure accurate and comparable WNS tests between diagnostic laboratories; the assessment of current laboratory capacity for processing WNS samples; projections of the capacity needed to support effective WNS management programs; promoting timely reporting of diagnostic results to resource agencies responsible for management decisions; and support WNS research. This group is also responsible for developing biosecurity recommendations for handling potentially infectious materials related to WNS. This working group will exist as a unique entity within the National WNS Plan organizational infrastructure until further notice by the WNS National Coordinator.

Diagnostic Working Group Leader

The Diagnostic Working Group leader is responsible for overseeing the subgroup leads, as needed, to implement, evaluate and update the *WNS Diagnostic Implementation Plan*. The leader will serve on the Coordination Team with the National WNS Coordinator and other working group leaders to provide recommendations to the steering committee and assist with the prioritization of research needs. In addition, the Diagnostic Working Group leader will provide an annual update to the WNS National Coordinator addressing the status of tasks identified in the *WNS Diagnostic Implementation Plan.* The leader will hold this position for a term of 2 years and may serve an unlimited number of terms pending majority approval by the Diagnostic Working Group.

Subgroup Leads

The Diagnostic Working Group is further subdivided into subgroups based upon the five goals outlined in the *National WNS Plan*. A subgroup lead will be nominated from the existing working group membership to oversee progress on the identified action items. The subgroup lead will hold this position for a 2-year term and may serve an unlimited number of terms pending majority approval by the Diagnostic Working Group. Subgroup leads are responsible for identifying tasks under relevant specific actions of the *National WNS Plan* and overseeing their progress in a timely fashion. This oversight may include recruiting others to assist in the completion of the tasks and/or by completing tasks themselves. Subgroup Leads are also responsible for keeping the Diagnostic Working Group leader informed of their progress and alerting the Group leader to any emerging issues that will require revision of relevant tasks identified in the *Diagnostic Implementation Plan*. All products generated from completed tasks are to be reviewed by members of the Diagnostic Working Group and revisions made by the Subgroup Lead. Finalized products will be submitted to the Diagnostic Working Group leader for conveyance to the National WNS Coordinator and Steering Committee and for dissemination by the Communications Working Group.

Working Group General Membership

Group members are expected to assist in the development and review of documents as requested by the working group leader or subgroup leads. In addition, participation on periodic conference calls hosted by the Diagnostic Working Group leader is expected and will be required of member labs within the proposed WNS Diagnostic Lab Network (WNS DLN). The WNS DLN will consist of a representative from each laboratory agreeing to the criteria for participation as developed by the Diagnostic Working Group. Each laboratory in the DLN will have one vote, regardless of the number of people from the lab participating on the working group. Labs will retain their membership in the WNS DLN for the duration of their willingness to abide by the standards endorsed by the Diagnostic Working Group. International diagnostic labs may participate in the WNS DLN as non-voting members.
Current members of the Diagnostic Working Group are in Appendix 1.

ACTION PLAN

Five strategic goals and their associated action items were outlined in the *National WNS Plan* as crucial components for establishing a coordinated national diagnostic effort for WNS and are included here for reference. These goals and action items serve as a starting point to develop and assign specific tasks within the framework of an adaptive *Diagnostic Implementation Plan* document (Appendix 2) to successfully address these components. If revisions to existing actions and tasks are needed or additional actions are identified in the future as critical components to meet the stated goals, these, and their associated tasks, will be incorporated into the adaptive *Diagnostic Implementation Plan* document.

Goal 1: Develop consensus standards for WNS testing and interpretation.
Action Items:
Make WNS diagnostic assays available through peer-reviewed publications, protocol summaries, workshops/conferences, and on-site training. This information would be available internationally. Communication among participating labs assures consistent assay application, interpretation and diagnoses.

Goal 2: Establish sufficient laboratory testing capacity for WNS/Pd diagnosis.
Action Items:

1. Assess laboratories currently involved in WNS diagnostics for sample processing capacity by the various assay methods (histology, PCR, fungal culture, light microscopy).
2. Survey resource agencies for their projected short-term and long-term WNS diagnostic needs.
3. Assist agencies in identifying suitable diagnostic laboratories to help meet their disease management needs.
4. Assess funding requirements based on the projected diagnostic needs of resource agencies.

Goal 3: Assure quality of sample submissions and comparable results among participating diagnostic laboratories.
Action Items:

1. Provide training and/or descriptions of ideal sample quality and storage requirements needed for the available WNS assays to resource agencies for distribution to field biologists to ensure suitable sample submissions for diagnostic evaluation.
2. Provide case definitions for suspect and confirmed cases of WNS and classification criteria of contaminated hibernacula.

Goal 4: Assist with timely reporting of WNS testing results to inform resource management agencies for release to the broader WNS community.
Action:
Work with the Data Management Working Group to develop a secure, centralized diagnostic sample database for tracking sample results and disease progression.

Goal 5: Support WNS research such as epidemiology, treatment/management options, improved diagnostic assay development, etc.
Action Items:

1. Critically review current knowledge of WNS diagnosis to identify knowledge gaps and research needs.
2. Prioritize diagnostic research needs to fill identified knowledge gaps and determine funding requirements.
3. Help coordinate laboratory assistance with state- and federally funded WNS research projects requiring sample testing, and ensure that sufficient funding is allocated to support participating laboratories beyond their primary diagnostic priorities.

MONITORING AND EVALUATING THE WNS DIAGNOSTIC IMPLEMENTATION PLAN

The Diagnostic Working Group leader will assemble the working group members minimally on an annual basis via conference call, video conference, webinar, or other mechanisms.
The WNS Diagnostic Implementation Plan will be reviewed annually by the Diagnostic Working Group leadership (group leader and subgroup leads) or when significant issues for consideration are brought to the attention of the group leader. Requests to amend the Implementation Plan or specific products will be directed through the appropriate subgroup leader or the Diagnostic Working Group leader. Members will have to opportunity to comment on proposed revisions during a comment period after which the membership will vote to accept or reject revisions based on simple majority. Any approved revisions that require a change in laboratory procedure shall be incorporated by all member labs if feasible. Updates to the Diagnostic Implementation Plan or products generated from this document will be forwarded to the National WNS Coordinator, Steering Committee and Communications Working Group for dissemination.

APPENDIX 1. DIAGNOSTIC WORKING GROUP CONTACTS

Diagnostic Working Group Leader
Anne Ballmann
USGS National Wildlife Health Center
6006 Schroeder Rd.
Madison, WI 53711
608.270.2445 (office)
608.270.2214 (fax)
aballmann@usgs.gov

Diagnostic Subgroup Leaders

Lab Training	**Lab Capacity**	**Field Training**	**Database Consult**	**Research Support**
Kevin Keel 5315 Vet Med 3A UC-Davis Davis, CA 95616 mkkeel@ucdavis.edu 530.752.2941	Lisa Last 589 DW Brooks Dr SCWDS College of Veterinary Medicine Athens, GA 30602 lalast@uga.edu 706-542-1741	Beth Buckles AHDC, CVM Cornell University Upper Tower Rd. Ithaca, NY 14853 Elb36@cornell.edu 607.253.3319	Anne Ballmann-interim	TBD
Subgroup Members: David Blehert, USGS Carol Meteyer, USGS	Subgroup Members:	Subgroup Members:	Subgroup Members:	Subgroup Members: Carol Meteyer, USGS

Diagnostic Working Group Members (as of September 2013):

Anne Ballmann, USGS National Wildlife Health Center
Kevin Keel, University of California-Davis
Beth Buckles, Cornell University
David Blehert, USGS National Wildlife Health Center, dblehert@usgs.gov
Carol Meteyer, USGS Headquarters, cmeteyer@usgs.gov
Terry Spraker, Colorado State University Veterinary Diagnostic Lab, terry.spraker@colostate.edu
Colleen Duncan, Colorado State University Veterinary Diagnostic Lab, Colleen.duncan@colostate.edu
Lisa Last, Southeastern Cooperative Wildlife Disease Study, lalast@uga.edu
Melissa Behr, Wisconsin Veterinary Diagnostic Lab, melissa.behr@wvdl.wisc.edu
Kevin Drees, Northern Arizona University, kevin.drees@nau.edu

International Adjunct Members:

Scott McBurney, Canadian Cooperative Wildlife Health Centre, smcburney@upei.ca
Sebastien Puechmaille, University College Dublin (Ireland)
Gudrun Wibbelt, Leibniz Institute for Zoo and Wildlife Research (Germany)

Working Group Liaisons:

Gail Moede Rogall (Communications), USGS National Wildlife Health Center, gmrogall@usgs.gov
Michelle Verant (Epidemiology/Ecology/Research), USGS National Wildlife Health Center, mverant@usgs.gov
D McAloose (Stakeholders), Wildlife Conservation Society, dmcaloose@wcs.org

APPENDIX 2. DIAGNOSTIC IMPLEMENTATION PLAN, 2011-2015

Goal 1: Develop consensus standards for WNS testing and interpretation. (100-250 hours staff time)

Action No./ Task No.	Activity	Lead	Expertise Required	Review	Relative Order	Est. Timeframe	Estimated Budget & Status	In Progress
1.1 Ensure consistent reporting and interpretation of laboratory results.								
1.1.1	Develop case definitions.	WG leader	Diagnostics Working Group	Review requests should to be submitted to lead. Update as necessary based on consensus.	1	3/25/2010; Revised 12/28/2010	Staff time (40 hrs) Not funded	Completed
1.1.2	Clarify language that describes criteria necessary for classifying negative results at the individual, population, or hibernaculum levels.	WG leader	Diagnostics Working Group	Review requests should to be submitted to lead. Update as necessary based on consensus.	2	2012	Staff time (5 hrs) Not funded	
1.1.3	Develop guidelines/recommendations for application and interpretation of various WNS/Pd diagnostic assays based on geographic area, species of unknown susceptibility, etc. for diagnostic labs.	Lab Training Subgroup lead	Diagnostics Working Group	Review requests should to be submitted to lead. Update as necessary based on consensus.	1	Interpretation- 12/6/2010; Assay Application - 2012	Staff time (90 hrs) Not funded	X

1.1.4	Coordinate with Communications Working Group to post the most current products on the WNS website with appropriate audience access.	WG leader	Communications liaison	Annually	3	As needed	Staff time (5 hrs)	
1.2 Develop a Laboratory Reference Handbook to serve as minimum laboratory standard protocols for the WNS Diagnostic Laboratory Network (WNS DLN).								
1.2.1	Create SOP template for adding new WNS/Pd diagnostic assays to Reference Handbook.	Lab Training Subgroup lead	IT support if web-based		1	2012	Staff time (10 hrs) + $250 Not funded	
1.2.2	Develop standard operating protocols (SOPs) for the current WNS/Pd diagnostic methods Histopathology Pd PCR (standard, real-time) Pd DNA sequencing Pd fungal culture Light microscopy analysis of: Fungal tape lift Swab Feces	Lab Training Subgroup Lead	lead PIs of accepted procedures David Blehert, Carol Meteyer, Joe Okienowski, Kevin Keel, others	Review annually for updates or necessary additions.	2	2011-2015	Staff time (90 hrs.) Not funded	X
1.2.3	Coordinate with Communications Working Group to post WNS/Pd Lab Reference Handbook	WG leader	Lab Training Subgroup Lead;	Review annually to ensure most current Handbook is available.	3	As needed	Staff time (5 hrs.)	

	on the secure WNS website and make available to interested parties upon request.		Communications liaison					
1.3 Develop biosafety recommendations for facilities handling potentially WNS positive materials to reduce the risk of laboratory contamination or human-assisted fungal spread.								
1.3.1	Include guidelines on transferring infectious materials between labs. Identify source labs that can provide positive and negative controls for various assays.	Lab Training Subgroup Lead	WNS DLN	Review requests should to be submitted to WG Lead. Update as necessary based on consensus.	1	2012	Staff time (90 hrs.) Not funded	X
1.3.2	Develop an automated reporting system for the importation of infectious materials to labs conducting federally funded WNS research/diagnostics that would be made available to the WNS National Coordinator, WNS DLN, and local resource managers.	Lab Training Subgroup Lead	Data Management/ Integration Working Group; IT support		3	2013-2015	Development $4800 Maintenance $7500 annual Not funded	
1.3.3	Coordinate with Communications Working Group to post product on the secure WNS website and make available to interested parties upon request.	WG leader	Lab Training Subgroup Lead; Communications liaison	Review annually to ensure most current Handbook is available.	2	As needed	Staff time (5 hrs..)	

1.4 Establish mechanisms for disseminating information and training diagnosticians within the WNS DLN and others interested in meeting DLN standards.								
1.4.1	Explore establishment of a designated WNS Diagnostic Reference Lab to: Develop & maintain a set of WNS/Pd diagnostic proficiency standards for quality assurance testing of established or petitioning labs in the WNS DLN. Establish proficiency requirements for WNS DLN membership certification. Develop & maintain positive and negative control stocks for diagnostic assays Provide diagnostic confirmation for significant cases (new species, new geographic areas).	WG leader	Lab Training Subgroup lead, WNS National Coordinator	Outside Diagnostic Lab Accreditation Committee (i.e.: AAVLD, NAHLN, etc.)	1	2012 and on-going	$700,000 – 1,000,000 annually Not funded	
1.4.2	Conduct WNS/Pd diagnostic techniques training workshops for diagnosticians which could be held in concurrence with the annual meetings of veterinary diagnosticians	Lab Training Subgroup Lead	WNS DLN reference lab(s); Invited PIs of newly accepted	Anticipate conducting 1-2 training workshops per year in first 2 years, then reduce to alternate years based on demand	2	2012-2015	$40,000-55,000 annually *Funding could be offset by requiring a*	

	and wildlife health professionals or as webinars *and/or* Seek financial support for WNS diagnostic internships at WNS DLN member labs.		diagnostic techniques	and/or diagnostic innovations.			*workshop registration fee.* Not funded	
1.4.3	Facilitate internal communications within WNS DLN to address emerging issues, assay trouble-shooting, review of new techniques, confidential alerts, etc. by hosting periodic conference calls and/or establishing a secure electronic WNS DLN discussion board.	WG leader	Communications liaison; USFWS WNS web manager; subgroup leads	WG leader will be responsible for scheduling general conference calls and/or working with web manager to develop a private discussion board. Subgroup leads will be responsible for moderating discussions of their respective areas.	2	2011 -2015	Staff Time (200 hrs) *Budget item request of Communications Group and use of established USFWS WNS conference call line.* Funded	X

Goal 2: Ensure sufficient laboratory testing capacity for WNS/Pd diagnosis. (175 hours staff time)

Action No./ Task No.	Activity	Lead	Expertise Required	Review	Relative Order	Est. Timeframe	Estimated Budget & Status	In Progress
2.1 Establish a WNS Diagnostic Lab Network (WNS DLN). Generate and maintain a WNS Diagnostic Lab Network (WNS DLN) Directory.								
2.1.1	Develop minimum criteria for laboratories to participate in the WNS DLN.	Lab Capacity Subgroup Lead	Lab Training Subgroup lead; Veterinary Diagnostic Laboratory Standards		1	2012	Staff time (50 hrs.) Not funded	X
2.1.2	Invite labs known to be currently conducting WNS diagnostics to join the WNS DLN.	WG leader	Lab Capacity Subgroup lead; Lab Training Subgroup lead	Coordinate with Lab Training Subgroup Lead (or review panel) to ensure minimum criteria are met by individual labs to join and maintain membership in the DLN as needed and reviewed annually.	2	2012 and on-going as needed	Staff time (20 hrs.) Not funded	
2.1.3	Survey participating labs for testing capabilities and capacities.	Lab Capacity Subgroup leader	IT support to develop web form	Review annually. Update as needed.	2	3/2010 and on-going	Staff time (8 hrs.) + $200 Not funded	X
2.1.4	Provide financial assistance to WNS DLN to ensure standardization of most current methods and adequate diagnostic capacity.	WNS Executive Committee	WNS National Coordinator, WG leader, WNS DLN	Review annually.	1	2012-2015	$50,000-100,000 Not funded	

2.2 Assess current and future WNS diagnostic needs of state, federal, and tribal resource managers to evaluate laboratory capacity gaps.								
2.2.1	Survey state, federal, and tribal resource managers of their WNS diagnostic needs and current lab usage for these purposes.	Lab Capacity Subgroup leader	Non-federal agency to administer survey consultant	Repeat survey at the request of WNS National Coordinator or every 3 years.	1	States-9/2011 Fed/Tribes-2012	Staff time (8 hrs.) + $2000 Not funded	X
2.2.2	Provide summary report of current and projected WNS diagnostic needs of resource managers to WNS National Coordinator, Executive Steering Committee, and survey respondents.	WG leader	Lab Capacity Subgroup leader	To be completed within 6 weeks of closing survey.	2	2012, every 3 years	Staff time (25 hrs.) Not funded	X
2.2.3	Identify new labs that are providing WNS diagnostic services for resource managers that are outside of the WNS DNL so they may be extended an invitation to participate in the Network.	Lab Capacity Subgroup leader	WG leader; resource managers	Compile via survey (2.4.1) or as information becomes available.	2	2012 - 2015	Staff time (5 hrs.) Not funded	X
2.2.4	Provide update of WNS Diagnostic Laboratory Network efforts at annual WNS Science Meeting.	WG leader	All subgroup leaders	Annually as scheduled.	3	2011 - 2015	Staff time (30 hrs.) + $3000 annually Not funded	
2.3 Make available to resource managers a WNS Diagnostic Lab Network (WNS DLN) Directory.								
2.3.1	Compile a list of all participating labs in the WNS DLN with a point of contact and summarized table of diagnostic capabilities & capacity.	Lab Capacity Subgroup leader	N/A	Update as needed. Reviewed for POC annually.	1	3/25/2010	Staff time (5 hrs.) Not funded	X

2.3.2	Coordinate with Communications Working Group to post WNS DLN Directory and links to their bat submission guidelines on USFWS WNS website.	WG leader	Lab Capacity Subgroup lead, communicatio ns liaison	Update as needed. Review annually to ensure most current directly is available.	2	As needed	Staff time (5 hrs.)	

Goal 3: Assure quality of sample submissions and comparable results among participating diagnostic laboratories. (150 hours staff time)

Action No./ Task No.	Activity	Lead	Expertise Needed	Review	Relative Order	Est. Timeframe	Estimated Budget & Status	In Progress
3.1 Develop a reference field manual for resource managers/contractors describing WNS/Pd sampling methods, applications and interpretation.								
3.1.1	Develop standardized collection and storage protocols for the current WNS/Pd sampling methods based on diagnostic objectives. Whole carcass Wing punch biopsy Fungal tape slide Cave sediment UV fluorescence Swabbing of bat wing Feces	Field Training Subgroup Lead	Lab Training Subgroup lead; (lead PIs of accepted procedures)	Review annually for updates or necessary additions.	1	12/17/2009 (carcass, wing biopsy, fungal tape); 2012/13 (sediment, UV, wing swab, feces)	Staff time (60 hrs) Not funded	X
3.1.2	Review recommended bat euthanasia practices to ensure methods conform to approved AVMA/Wildlife guidelines and do not interfere with WNS diagnostic evaluation.	Field Training Subgroup Lead	Lab Training Subgroup lead; Animal Handling/Euthanasia Guidelines (AVMA, ASM, others)		3	2012/13	Staff time (10 hrs.) Not funded	
3.1.3	Develop basic description of current WNS diagnostic tests, interpretation, case definitions	Field Training Subgroup Lead	Lab Training Subgroup lead	Review annually for updates or necessary additions.	1	3/2010; revised 12/2010	Staff time (20 hrs.) Not funded	Completed

	and recommended usage of sampling methods.							
3.1.4	Coordinate with Communications and/or Surveillance Working Groups to post products on the secure WNS website and make available to interested parties upon request.	WG leader	Lab Training Subgroup lead; Field Training Subgroup lead	Review annually to ensure most current information is available to users.	2	As needed	Staff time (5 hrs.)	
3.2 Facilitate diagnostic information transfer to the field via training opportunities.								
3.2.1	Provide expertise at bat workshops or as webinars in area of WNS/Pd sampling methods and diagnostic interpretation as requested.	Field Training Subgroup Lead	WNS DLN membership		2	2010 and on-going	$3000-9000 + Staff time (60 hrs.) *Funding could be offset by requiring a workshop registration fee* Not funded	X

Goal 4: Assist with timely reporting of WNS testing results to inform resource management agencies for release to the broader WNS community. (25-40 hours staff time)

Action No./ Task No.	Activity	Lead	Required Expertise	Review	Relative Order	Est. Timeframe	Estimated Budget & Status	In Progress
4.1 Coordinate with the Data Management Working Group to develop a centralized WNS database for tracking WNS results.								
4.1.1	Identify key data fields related to WNS diagnostic reporting for inclusion in the database to assist with WNS surveillance efforts.	Database Consulting Subgroup lead	Disease modelers and epidemiologists from Surveillance and/or Epidemiology Working Groups	Review as requested by Data Management Working Group. Database Subgroup Lead will notify database manager when new WNS diagnostic tests are approved for use by WNS DLN.	1	2010-ongoing	Staff time (20 hrs) In progress-partial	X
4.2 Facilitate timely data sharing among WNS DLN to assist with diagnostic efforts.								
4.2.1	Establish confidential lab alert and reporting guidelines for WNS/Pd positive results within WNS DLN.	WG leader; Lab Training Subgroup lead	WNS DLN; Data Management Group?; Communications leader	Automatic email alert sent to WNS DLN members of positive test results in new species, new geographic areas from WNS Database	3	2013	Staff time (10 hrs) Not funded	
4.2.2	Respond to requests from the National WNS Coordinator for WNS DLN summary data.	WG leader	WNS DLN		1	As needed	Staff time (20 hrs) Not funded	

Goal 5: Support WNS research such as epidemiology, treatment/management options, improved diagnostic assay development, etc. (150 hours staff time)

Action No./ Task No.	Activity	Lead	Required Expertise	Review	Relative Order	Est. Timeframe	Estimated Budget & Status	In Progress
5.1 Provide technical review of WNS/Pseudogymnoascus destructans diagnostic methods to the WNS National Coordinator, Steering Committee, and Executive Committee.								
5.1.1	Evaluate feasibility of desired diagnostic tests to assist with prioritization of limited research funds.	Research Subgroup lead (TBD); Carol Meteyer - interim	Mycologists, Pathologists, Microbiologists, Molecular biologists, Immunologists		3	As needed	Staff time (30 hrs) Not funded	
5.1.2	Identify sampling and/or diagnostic research gaps.	Research Subgroup lead (TBD)		Reviewed annually based on WNS working group priorities or at the request of WNS Nat'l Coordinator.	3	2012	Staff time (30 hrs) Not funded	
5.2 Facilitate collaborations on large-scale research projects between multiple states and/or agencies with laboratories within the WNS DLN.								
5.2.1	Identify interested labs within the WNS DLN that provide the necessary diagnostic capabilities and geographic distribution for proposed research studies.	Research Subgroup lead (TBD); interim -WG leader	WNS DLN	Done at the request of the USFWS National WNS Coordinator.	2	As needed	Staff time (10 hrs) Not funded	

5.2.2	Coordinate diagnostic protocols among multiple collaborating labs.	Research Subgroup lead (TBD)	Lab Training Subgroup lead; PI(s)	Review as needed.	3	As needed	Staff time (20 hrs) Not funded	
5.3 Review experimental WNS/Pd sampling and/or diagnostic techniques for inclusion into the WNS DLN Assay Reference Handbook (1.2; 3.1).								
5.3.1	Develop standard criteria for reviewing and approving new sampling and/or diagnostic techniques into Reference Manuals.	Research Subgroup lead (TBD)	OIE Lab Standards; NAHLN standards	Reviewed as needed by WNS DLN	1	2012	Staff time (30 hrs) Not funded	
5.3.2	For methods that are developed outside of the WNS DLN and independent of federal WNS funding, novel technique(s) should be evaluated in tandem with established methods on WNS training standards.	Research Subgroup lead (TBD)	Independent lab within WNS DLN *(or designated WNS Reference Lab)*	Request made to review/evaluate novel technique can originate from PI, Nat'l WNS Coordinator, other WNS working groups or sponsoring member of WNS DLN. Research subgroup lead identifies an independent lab/labs within the WNS DLN for assay validation.	2	As needed	TBD *(Est. $50,000-100,000 per project)* Funding is necessary for independent WNS DLN validation if requested by NationalWNS Coordinator. Not funded	

5.3.3	For novel method(s) developed by a lab/labs within the WNS DLN or supported by USFWS WNS funding, the sponsoring lab must evaluate novel technique(s) in tandem with established WNS DLN method(s).	Research Subgroup lead (TBD)	Independent lab within WNS DLN *(or designated WNS Reference Lab)*	Request made to approve novel technique originates from PI or Research Subgroup Lead. Research subgroup lead identifies an independent lab/labs within the WNS DLN for assay validation.	2	As needed	TBD *(Est. $50,000-100,000 per project)* PI is responsible for securing own funds for comparative evaluation. Funding is necessary for independent WNS DLN validation. Not funded	
5.3.4	Develop accompanying sampling and/or diagnostic protocols to be added to Reference handbooks.	Research Subgroup lead (TBD)	Lab Training and/or Field Training Subgroup leads; PI	Review annually by Lab Training Subgroup and update as needed.	3	As needed	Staff time (20 hrs.) Not funded	
5.3.5	Coordinate with Communications Working Group to disseminate new diagnostic information to WNS Investigation Community.	WG leader	Research Subgroup Lead (TBD); Communications liaison		3	As needed	Staff time (5 hrs.)	

APPENDIX 3. BUDGET & STAFF HOURS SUMMARY BY GOALS

		Year					
WNS National Plan Goal		**2011**	**2012**	**2013**	**2014**	**2015**	**Total**
Develop consensus standards for WNS testing/ interpretation	Staff Time* (Hours)	100	250	150	150	150	800
	Budget (Dollars)	$0	$753,000 - 1.07 mil	$753,000 - 1.07 mil	$753,000 - 1.07 mil	$753,000 - 1.07 mil	$3.01 mil- 4.28 mil
Ensure sufficient lab capacity	Staff Time* (Hours)	50	175	175	175	175	750
	Budget (Dollars)	$0	$55,200-105,200	$55,200-105,200	$55,200-105,200	$55,200-105,200	$220,800-420.800
Assure quality sample submissions for comparable results	Staff Time* (Hours)	50	150	150	150	150	650
	Budget (Dollars)	$0	$3000-9000	$3000-9000	$3000-9000	$3000-9000	$12,000- 36,000
Lab result reporting and data capture	Staff Time* (Hours)	25	40	40	25	25	155
	Budget (Dollars)	$0	$0	$0	$0	$0	$0
WNS/Pd research support	Staff Time* (Hours)	0	150	150	150	150	600
	Budget (Dollars)	0	TBD *($50,000-200,000)*	TBD *($50,000-200,000)*	TBD *($50,000-200,000)*	TBD *($50,000-200,000)*	TBD *($200,000-800,000)*
Total	Staff Time* (Hours)	225	765	665	650	650	2955
	Budget (Dollars)	$0	$861,200-1.38 mil	$861,200-1.38 mil	$861,200-1.38 mil	$861,200-1.38 mil	$3.44 mil – 5.52 mil

*Staff time listed is not included in the estimated annual budget and is estimated based on current group membership of 8 individuals.

Disease Management Implementation Plan for The National Plan for Assisting States, Federal Agencies, and Tribes in Managing White-Nose Syndrome in Bats

2011-2015

Submitted by: _____ Date: _____
Brooke Hines, Kentucky Department of Fish and Wildlife Resources
Disease Management Working Group Leader

Approved by: _____ Date: _____
Jeremy Coleman, USFWS
National White-nose Syndrome Coordinator

TABLE OF CONTENTS

EXECUTIVE SUMMARY

The *National Plan for Assisting States, Federal Agencies, and Tribes in Managing White-Nose Syndrome in Bats (National WNS Plan)* provides a static framework which outlines the necessary actions for coordination of state and federal efforts to address white-nose syndrome. Implementation of the elements detailed in the *National WNS Plan* will require continual modification as new information becomes available. Working groups were created to address the identified seven critical elements and will be responsible for developing and maintaining the various actions identified for each element in *National WNS Plan*. Each working group will develop an implementation plan outlining this process.

The purpose of the Disease Management Working Group is to identify a range of alternatives and best practices to slow or prevent the introduction of WNS into new areas. This may be accomplished by investigating ways to decrease the virulence of the disease, increase survivorship of infected individuals, and minimize the efficacy of the disease in affected areas while avoiding unacceptable risks to other cave-obligate biota and natural systems. This group will assist state, federal and tribal agencies in determining the goals of management actions taken and the most feasible management tools that can be applied.

LIST OF PREPARERS

The following people served on the Disease Management Working Group writing team to develop this implementation plan between May 2011 and March 2012:

Alan Hicks, Vesper Environmental LLC

Brooke Hines, Kentucky Department of Fish and Wildlife Resources

Greg Turner, Pennsylvania Game Commission

IMPLEMENTATION STRATEGY

DISEASE MANAGEMENT WORKING GROUP ROLES AND RESPONSIBILITIES

The Disease Management Working Group has three objectives:

1. Identify and implement science-based management actions to slow or stop the expansion of WNS, in order to delay, for as long as possible, the impacts of the disease reaching unaffected regions of the continent.

2. Develop and employ interventional strategies to the disease that will ensure the perpetuation of susceptible bat species, and that will provide the best opportunities for their recovery to pre-WNS numbers in affected regions.

3. Ensure that implemented actions will not be detrimental to bat populations or have unacceptable effects on the ecosystems in which they are found.

The Disease Management Working Group is a diverse assignment requiring too broad an array of specific skill sets to be addressed by a single team of specialists. Five sub-groups were created to focus on the different goals and actions identified in the *National WNS Plan*:

1. Environmental Manipulations – Identifies and promotes research and management to reduce the effects of WNS through environmental manipulations within hibernacula or summer roosts. This subgroup will focus on *National WNS Plan* Goals *D.2.3, D.2.4 and D.2.5*.
2. Decontamination – Identifies and promotes research and management to reduce the risk of the disease being spread by humans. This subgroup will focus on *National WNS Plan* Goal D.2.2.
3. Chemical Control – Identifies and promotes research and management actions to reduce the effects of WNS through the use of chemical agents. This subgroup will focus on *National WNS Plan* Goals D.2.3, D.2.4, and D.2.5.
4. Biological Control – Identifies and promotes research and management actions to reduce the effects of WNS through the use of biological agents. This subgroup will focus on *National WNS Plan* Goals D.2.3, D.2.4, and D.2.5.
5. Commercial/Show Cave Guidance – Development of a national guidance document that is protective for the bats and reasonable for the public. This subgroup will focus on *National WNS Plan* Goals D.1.1 and D.2.2b, D.2.2c, and D.3.

Contact information for the working group leader and subgroup leaders are provided in Appendix 1. These individuals will be responsible for coordination of and within the subgroups and will serve to oversee implementation of this plan. Members of the Disease Management Working Group (Appendix 2) are responsible for helping complete goals, actions and tasks assigned to each team.

To ensure information and accomplishments are shared in a timely manner between the working groups, a communications liaison from the Communications and Outreach Working Group has been assigned to the Disease Management Working Group (Appendix 1).

DISEASE MANAGEMENT ACTIVITY SCHEDULE

Six strategic goals, along with several action items, were outlined in the *National WNS Plan* to identify a range of alternatives and best practices to slow or prevent the introduction of WNS into new areas. These goals and action items were used to develop and prioritize the Disease Management Activity Schedule (Appendix 3).

This schedule represents the core of this implementation plan. It contains specific tasks, that when implemented, will help this working group move closer to achieving the *National WNS Plan* goals – that is, conserving and recovering species affected by WNS.

National WNS Plan Disease Management Goals and Action Items

Goal 1: Critically review current knowledge of WNS disease management to identify knowledge gaps and research needs.

Action Items:

1. Solicit expert review of previous and current research projects and identify knowledge gaps.
2. Identify priority research questions and capacity not currently being addressed in the investigation of WNS, including human dimensions
3. Identify high-priority laboratory and field activities needed to support research priorities.

Goal 2: Reduce the risk of WNS transmission by humans.

Action Items:

1. Identify the mechanisms for WNS transmission by humans to the environment then to bats.
2. Provide guidance on regulation or restriction of human actions that are likely to pose a risk for spreading WNS.
   (a) Develop standards for restricting use of potentially contaminated gear (both caving and bat research) at unaffected sites or regions.
   (b) Manage cave access to minimize transmission risk.
   (c) Work with cave owners to implement operating guidelines for commercial caves.
   (d) Modify mist netting and harp trapping protocol/techniques.
   (e) Investigate the potential risks of commercial trafficking of bat guano to the spread of WNS.
3. Develop, implement, and where possible, enforce decontamination/disinfection protocols to guard against human-assisted transmission of WNS to new sites or animals.

Goal 3: Reduce inter-/intra-specific transmission and disease spread.

Action Items:

1. Investigate bat-to-bat transmission of WNS.
   (a) Identify prevalence/distribution of infected animals within hibernacula/clusters.
   (b) Develop techniques for identifying infected animals (photo/thermography).
   (c) Determine effectiveness of in situ management actions (e.g., removal of infected and adjacent individuals, temporary barriers to infected substrates, etc.).

(d) Investigate the potential for tree bats to serve as carriers of P. *destructans*.

Goal 4: Reduce environmental transmission to and from bats.

Action items:

1. Investigate WNS transmission from environment-to-bat.
2. Develop environmental decontamination techniques.

Goal 5: Eliminate *P. destructans* from infected individuals.

Action items:

1. Investigate means of *P. destructans* control that are effective and safe for the bats.
   (a) Identify chemical control treatments for *P. destructans*.
   (b) Identify biological control treatments for *P. destructans*.
   (c) Identify effective environmental manipulations to reduce or eliminate *P. destructans* from affected bats or sites.
   (d) Identify effective bat exclusion/inclusion of infected sites/uninfected sites.
2. Reduce disturbance-related mortality associated with disease management activities.

Goal 6: Identify and limit adverse ecological impacts of management actions, including decontamination techniques, to within acceptable limits.

Action Items:

1. When appropriate, research the need for, conduct, and/or support human dimensions inquiries to define acceptable limits for ecological impacts.
2. Monitor management action outcomes and use adaptive management iterations to improve results, in light of potential ecosystem impacts.

MONITORING AND EVALUATING THE DISEASE MANAGEMENT IMPLEMENTATION PLAN

The Disease Management Working Group leader will assemble the subgroup and/or working group members, as necessary, via conference call, video conference, webinar, or other technology.

The Disease Management Implementation Plan will be reviewed annually by the group leadership (group leaders and subgroup leads) or when significant issues for consideration are brought to the attention of the working group leader. Requests to amend the Implementation Plan or specific products will be directed through the appropriate subgroup leader or the working group leaders. Members of the working group and/or subgroups will have an opportunity to comment on proposed revisions during a comment period after which there will be voting among the membership to accept or reject the revisions based on simple majority. Updates to the Disease Management Implementation Plan or products generated from this document will be forwarded to the National WNS Coordinator and Communications Working Group for dissemination.

APPENDIX 1. DISEASE MANAGEMENT WORKING GROUP LEADERSHIP CONTACTS

DISEASE MANAGEMENT WORKING GROUP LEADER

The working group leader is responsible for ensuring the efforts of the subgroups are: consistent with the *National WNS Plan*, complementary to the actions of other subgroups and other working groups, and meet the goals and objectives of the Disease Management Working Group in a timely fashion. The leader will involve the communications liaison in working group meetings and business, as necessary. The leader will serve on the Coordination Team with the WNS coordinators and other working group leads to provide recommendations to the steering committee and prioritize research needs.

Current Leader
Brooke Hines, Bat Ecologist
Kentucky Department of Fish and Wildlife Resources
#1 Sportsman's Lane
Frankfort, KY 40601
Phone: 502.564.3400 ext. 4573
brooke.hines@ky.gov

Communications and Outreach Working Group Liaison
Gail Moede-Rogall, Information Specialist
USGS Midwest Area
6006 Schroeder Road
Madison, WI 53711
Phone: 608-270-2438
gmrogall@usgs.gov

Environmental Manipulations	*Decontamination*	*Biological control*	*Chemical control*	*Commercial Cave Guidance*
Susi von Oettingen **Endangered Species Biologist** U.S. Fish and Wildlife Service New England Field Office 70 Commercial Street Suite 300 Concord, NH 03301 603-223-2541 x22 Susi_vonOettingen@fws.gov	**Rich Geboy** **Region 3 WNS Coordinator** U.S. Fish and Wildlife Service Bloomington Field Office 620 South Walker St. Bloomington, IN 47403 812-334 4261 x210 richard_geboy@fws.gov	**Alan Hicks** **Wildlife Biologist** Vesper Environmental LLC 52 Higgins Rd West Sand Lake ,NY 12196 518-860-8805 achicks@nycap.rr.com	**Brooke Hines** **Bat Ecologist** Kentucky Department of Fish and Wildlife Resources #1 Sportsman's Lane Frankfort, KY 40601 502-564-3400 ext. 4573 brooke.hines@ky.gov	**Kevin Castle** **Veterinarian** Biological Resource Management Division Natural Resource Stewardship and Science National Park Service 1201 Oakridge Drive, Suite 200 Fort Collins, CO 80525 970-267-2162 Kevin_Castle@nps.gov

SUBGROUP LEADERS

APPENDIX 2. DISEASE MANAGEMENT WORKING GROUP MEMBERSHIP

The following individuals are recognized as members of the Disease Management Working Group. These individuals have provided, or intend to provide, time or expertise to help implement the activities listed within this plan. The membership list will be updated annually.

Mike Armstrong, U.S. Fish and Wildlife Service

Anne Ballmann, U.S. Geological Survey, National Wildlife Health Center

Hazel Barton, University of Akron

Eric Britzke, U.S. Army Engineer Research and Development Center

Emily Preston, New Hampshire Fish and Game Department

Vishnu Chaturvedi, New York State Department of Health

Scott Darling, Vermont Fish and Wildlife Department

Chris Dobony, Department of Defense -Fort Drum

Bill Elliot, Missouri Fish & Wildlife

Mahmoud Ghannoum, Case Western Reserve University

Michael Herder, Bureau of Land Management

Carl Herzog, New York State Department of Environmental Conservation

Joe Kath, Illinois Department of Natural Resources

Kevin Keel, University of California Davis

Christina Kocer, U.S. Fish and Wildlife Service

Dennis Krusac, U.S. Forest Service

Rory Lamp, Nevada Department of Wildlife

Angie McIntire, Arizona Fish and Wildlife

Holly Neideritter, Delaware Department of Natural Resources and Environmental Control

Pat Ormsbee, U.S. Forest Service

Joe Okoniewski, New York State Department of Environmental Conservation

Dave Redell, Wisconsin Department of Natural Resources

DeeAnn Reeder, Bucknell University

Allison Robbins, Tufts Cummings School of Veterinary Medicine

Craig Stihler, West Virginia Division of Natural Resources

Marci Souza, University of Tennessee

Steve Thomas, National Park Service

Greg Turner, Pennsylvania Game Commission

Susi von Oettingen, U.S. Fish and Wildlife Service

APPENDIX 3. DISEASE MANAGEMENT ACTIVITY SCHEDULE, 2011-2015

The following tables highlight activities necessary to develop, test, and implement WNS disease management strategies for the period 2011-2015. In many cases, aspects of these strategies are shared by multiple working groups. Their completion will be collaborative efforts between them as various states, federal and tribal agencies, and NGO's. Members of the Disease Management Working Group will contribute their expertise to coordinate meetings and develop protocols or produce specific products. In some cases, it will be necessary for federal, state, and tribal natural resource agencies to take a lead role in implementing protocols or in utilizing databases or products. Estimates for timeframes and budgets will be reviewed annually and updated. Staff hours represent the involvement of agencies directly affiliated with, and responsible for, wildlife resource management. Dollar values are primarily costs to non- resource agency contributors or costs that are outside the normal scope of work for resource agencies.

Goal 1. Critically review current knowledge of disease management and subsequently identify knowledge gaps and research needs related to WNS.

Action No./ Task No.	Activity	Lead	Required Expertise	Review	Relative Order	Est. Timeframe	Estimated Budget & Status	In Progress
Action Item 1.1 Solicit expert review of previous and current research projects and identify knowledge gaps								
1.1	Review ongoing research, published research, and identify priorities for RFP's (Request for Proposals).	Steering Committee & National WNS Coordinator	N/A	Biannually	3	2011-2012	Staff Time (600 hrs.)	Completed
Action Item 1.2 Identify priority research questions and capacity not currently being addressed in the investigation of WNS, including human dimensions.								
1.2	Create a list of research priorities that reflects current gaps in disease management.	DMWG members	Other working groups	Annually	2	2011-2015	Staff Time (500 hrs.)	Completed

Action Item 1.3: Identify high-priority laboratory and field activities needed to support research priorities.								
1.1.3	Identify high-priority laboratory and field activities needed to support research priorities.	DMWG members	Other working groups	Annually	2	2011-2015	Staff Time (1,000 hrs.)	Completed

Goal 2: Reduce the potential impacts associated with human visitation

Action No./ Task No.	Activity	Lead	Required Expertise	Review	Relative Order	Est. Timeframe	Estimated Budget & Status	In Progress
Action Item 2.1: Identify the mechanisms for WNS transmission by humans to naïve bats								
2.1.1	Determine if P.d. grows/thrives in hibernacula independent of bats.	Epidemiology and Etiology Working Group	WNS, wildlife disease, mycology research labs (SCWDS, NWHC, others)	N/A	1	2011-2013	$100,000	Not funded
2.1.2	Determine what role, if any, human activities may have on spread of P.d. within the site or to other sites.	Epidemiology and Etiology Working Group	WNS, wildlife disease, mycology research labs (SCWDS, NWHC, others)	N/A	1	2011-2013	$70,000	Not funded
Action Item 2.2: Develop, implement, and where possible, enforce decontamination/disinfection protocols to guard against human-assisted transmission of WNS to new sites (inter-and intra-continental) or animals.								
2.2.1	Disseminate decontamination protocols to the public through state and federal agencies.	Communications Working Group	N/A	Based on new developments	3	2012	$3,000	Completed

2.2.2	Develop a uniform FAQ to ensure consistency in implementation.	Communications Working Group, state agencies	N/A	Based on new developments	3	2012-2015	Staff Time (200 hrs.) + $10,000	Not funded
Action Item 2.3: Provide guidance on regulation or restriction of human actions that are likely to pose a risk for spreading WNS.								
2.3.1	Develop standards for restricting use of potentially contaminated gear (both caving and bat research) at unaffected sites or regions.	Decontamination Subcommittee, state and federal agencies	WNS research labs	Based on new developments	1	2013	Staff Time (700 hrs.)	Completed
2.3.1.1	Develop decontamination protocols for cavers and researchers.	USFWS, Steering Committee, Decontamination Subcommittee	WNS research labs	Based on new developments	1	2012		Completed
2.3.2	Manage cave access to reduce transmission risk.	Steering Committee, state and federal agencies	NSS, cave owners, WNS research labs	Based on new developments	1	2012	Staff Time (1,000 hrs.) + $15,000	Not funded
2.3.2.1	Gain cave owner compliance with cave access policies by providing WNS info, state and federal WNS lead agency contact info, and signage and outreach material.	State and federal agencies	Cave owners	Annually as needed	3	2012	Staff Time (800 hrs.) + $10,000	Not funded
2.3.3	Collaborate with cave owners to implement operating guidelines for commercial caves.	Commercial Cave Group	National Cave Association, other commercial cave owners, interested parties	Based on operating guidelines	3	2012-2014	Staff time (2,000 hrs.) + $15,000	Not funded

Action No./ Task No.	Activity	Lead	Required Expertise	Review	Relative Order	Est. Timeframe	Estimated Budget & Status	In Progress
2.3.3.1	Develop a "WNS Commercial Cave Guidance" with commercial cave owners.	Commercial Cave Group	National Cave Association, commercial cave owners	Annually	1	2014-2015	Staff time (1,000 hrs.) + 10,000	Not funded
2.3.4	Determine if there are differences in infection or contamination rates among bat species/sex/age classes.	USFWS	State agencies and researchers	Annually	3	2011-2013	$250,000	Not funded
2.3.4.1	Assure that the Decontamination Protocol reflects current knowledge of WNS and Decontamination Guidelines.	State and federal agencies	State agencies and researchers	Annually	3	2012	Staff Time (400 hrs.) + $5,000	Not funded
2.3.5	Determine if bat guano carries viable P.d. spores, and if commercial activities (mining, sale, terrestrial application) pose risk infection.	USFWS	University mycology labs, state and federal agencies	N/A	3	2015	$20,000	Not funded
2.3.5.1	Evaluate risk of spreading P.d. to uninfected regions (continents) by the bat guano mining industry.	Decontamination Subcommittee	State and federal agencies	N/A	3	2015	$10,000	Not funded
2.3.5.2	Develop decontamination protocols for bat guano miners if risk is established.	Decontamination Subcommittee	State and federal agencies	As needed	3	2015	Staff time (200 hours) + $2,000	Not funded
Action Item 2.4: Evaluate the effects of repeated or prolonged, disturbance and eliminate impacts caused by disturbance to hibernating bats								
2.4.1	Determine the effects of winter disturbance on survival, including,	Disease Management Working Group	State, federal and researchers	As needed	2	2014	Staff Time (4,000 hrs.) + $150	Partially funded

	but not limited to, naïve bats and bats previously exposed to P.d.							
2.4.1.1	Determine effects of disturbance on female reproductive output and juvenile survivorship.	Disease Management Working Group	State, federal and researchers	As needed	3	2015	Staff Time (2,000 hrs.) + $20,000	Not funded
2.4.2.1	Produce educational material on impacts/benefits and present to congressional leaders, influential conservation organizations.	Steering Committee	Steering Committee	As needed	3	2012	$20,000	Completed
2.4.2	Seek compliance to control human access at all hibernacula when occupied by bats.	State and federal agencies	Regulatory authority	As needed	3	2015	Staff Time (2,500 hrs.) + $50,000	Not funded
2.4.3	Evaluate survivorship and productivity from the effects of bat handling during hibernation.	Disease Management Working Group and Conservation and Recovery Working Group	State, federal and researchers	As needed	2	2011-2013	Staff Time (3,000 hrs.) + $100,000	Partially funded
2.4.3.1	Determine the effects of bat banding and pit tagging on hibernating bats.	Disease Management Working Group	State, federal and researchers	As needed	1	2011-2014	Staff Time (4,000 hrs.) + $150,000	Partially funded

Goal 3: Reduce inter/intra-specific transmission and disease spread

Action No./ Task No.	Activity	Lead	Required Expertise	Review	Relative Order	Est. Timeframe	Estimated Budget & Status	In Progress
Action Item 3.1 **Identify prevalence/distribution of infected animals within hibernacula/clusters**								
3.1.1	Determine if individuals within colonies become infected after the mass mortality phase.	Disease Management Working Group	State, federal and university researchers	As needed	2	2012-2014	Staff Time (2,000 hrs.) + $10,000	Partially funded

3.1.2	Determine if infection levels remain constant within colonies in successive years.	Disease Management Working Group	State, federal and university researchers	As needed	2	2015	Staff Time (3,000 hrs.) + $150,000	Partially funded
3.1.3	Determine if individuals can be infected in multiple years.	Disease Management Working Group	State, federal and university researchers	As needed	2	2012-2013	Staff Time (4,000 hrs.) + $10,000	Partially funded
3.1.4	Determine the relative susceptibility of each temperate hibernating bat species under standard conditions.	Epidemiology/Etiology Working Group	State, federal and university researchers	As needed	1	2011-2013	Staff Time (6,000 hrs.) + $40,0000	Not funded
Action Item 3.2: Develop techniques for identifying infected animals (photo/thermography)								
3.2.1	Determine if UV light photo documentation can detect P.d. infection by comparing with histology tests.	Diagnostics Working Group	State, federal and university researchers	As needed	2	2012		Completed
3.2.2	Compare standard photo, UV photo and PCR to assess the utility of each in detecting infection in hibernating animals.	Diagnostics Working Group	State, federal and university researchers	As needed	2	2013-2015	Staff Time (5,000 hrs.)	Not funded
3.2.3	Develop standard photography, UV light photography, and swab protocols.	Diagnostics Working Group	State, federal and university researchers	As needed	2	2013-2015	Staff Time (20 hrs.) + $20,000	Not funded
Action Item 3.3: Determine effectiveness of in situ management actions (e.g., removal of infected and surrounding individuals, temporary barriers to infected substrates, etc.)								
3.3.1	Determine the effectiveness of installing temporary barriers to contaminated roosts in reducing winter infection/mortality rates.	Disease Management Working Group	State, federal and university researchers	As needed	2	2011-2014	Staff Time (3,000 hrs.) + $75,000	Not funded

3.3.2	Determine the effectiveness of artificial, removable and cleanable temporary roosts/hibernacula in reducing colony infection and mortality rates.	Epidemiology and Etiology Working Group	Researchers	As needed	3	2013-2014	Staff Time (4,000 hrs.) + $75,000	Not funded
3.3.2.1	Evaluate techniques to remove viable spores from hibernacula roosts, etc.	Epidemiology and Etiology Working Group	Researchers	As needed	2	2012-2014	Staff Time (4,000 hrs.) + $75,000	Partially funded
Action Item 3.4: Investigate the potential for tree bats to serve as carriers of G. destructans								
3.4.1	Evaluate techniques to remove viable spores from hibernacula roosts, etc.	Epidemiology and Etiology Working Group	Researchers	As needed	2	2012-2014	Staff Time (4,000 hrs.) + $75,000	Partially Funded

Goal 4: Reduce environmental transmission to and from bats.

Action No./ Task No.	Activity	Lead	Required Expertise	Review	Relative Order	Est. Timeframe	Estimated Budget & Status	In Progress
Action Item 4.1 Investigate WNS transmission from environment-to-bat								
4.1.1	Define the risk of transmission from summer and winter.	Disease Management Working Group, Epidemiology and Etiology Working Group	Researchers	As needed	1	2011-2013	Staff Time (6,000 hrs.) + $150,000	Not funded
Action Item 4.2: **Develop environmental decontamination techniques**								
4.2.1	Develop and test methods to control P.d. abundance in hibernacula.	Epidemiology/Etiology Working Group	SCWDS, researchers	As needed	2	2012-2014	Staff Time (4,500 hrs.) + $500,0000	Partially funded

Action Item 4.3: **Identify effective bat exclusion/inclusion of infected sites/uninfected sites**								
4.3.1	Develop and test the effectiveness of excluding bats from entire infected hibernacula or specific hibernacula roosts.	Disease Management Working Group	State and federal agencies	As needed	3	2013	Staff Time (1,500 hrs.) + $20,000	Not funded

Goal 5: Goal 5. Eliminate P. destructans from infected individuals

Action No./ Task No.	Activity	Lead	Required Expertise	Review	Relative Order	Est. Time frame	Estimated Budget & Status	In Progress
Action Item 5.1 Identify means of P d. control that are effective and safe for the bats								
5.1.1.	Identify, develop, and test biological control agents for application on bats.	Disease Management Working Group	State, federal and univeristy researchers	As needed	1	2011-2015	Staff Time (4,000 hrs.) + $700,000	Partially funded
5.1.2.	Identify, develop, and test chemical control agents for application on bats.	Disease Management Working Group	State, federal and univeristy researchers	As needed	1	2011-2015	Staff Time (3,500 hrs.) + $600,000	Partially funded

5.1.3.	Determine the most effective time to remove infected bats during hibernation and maintain them in a euthermic state that will increase survivorship.	Disease Management Working Group	State, federal and univeristy researchers	As needed	1	2015	Staff Time (2,000 hrs.) + $250,000	Partially funded
5.1.4.	Determine the costs associated with each successful P.d. treatment option.	Disease Management Working Group	State, federal and univeristy researchers	As needed	2	2014	Staff Time (1,000 hrs.) + $10,000	Not funded
5.1..5.	Closely monitor the infection/survival rate of treated and untreated individuals at hibernacula to determine the efficacy of, and the need for, treatments.	Disease Management Working Group and Epidemiology/Etiology Working Group	State, federal and univeristy researchers	As needed	1	2014	Staff Time (2,000 hrs.) + $100,000	Not funded
5.1..5.1	Develop and install automated monitoring systems (PIT tags, acoustical detectors, and automated counters) to minimize winter disturbance, identify behavioral shifts, and remove biases associated with hibernacula surveys.	Disease Management Working Group and Diagnostics Working Group	State, federal and univeristy researchers	As needed	1	2011-2015	Staff Time (4,500 hrs.) + $300,000	Partially funded

Goal 6: Identify and limit adverse ecological impacts of management actions to acceptable limits

Action No./ Task No.	Activity	Lead	Required Expertise	Review	Relative Order	Est. Timefr ame	Estimat ed Budget & Status	In Progress
Action Item 6.1 Monitor for ecosystem impact s resulting from management actions and employ adaptive management to lessen impacts								
6.1.1.	Limit preliminary testing of control agents to human-made hibernacula.	Disease Management Working Group	State, Federal and University Research	As needed	1	2013	Staff Time (1,000 hrs.)	Not funded
6.1.2.	Collect data to establish the fungal and bacterial baseline community in uninfected? hibernacula.	Disease Management Working Group	State, federal and univeristy researchers	As needed	2	2012-2015	Staff Time (2,000 hrs.) + $400,000	Partially funded
6.1.3.	Monitor changes in native fungal and bacterial communities at treated sites to determine adverse impacts from management actions.	Disease Management Working Group	State, federal and univeristy researchers	As needed	2	2015	Staff Time (2,500 hrs.) + $200,000	Not funded

APPENDIX 4. BUDGET SUMMARY BY GOAL

WNS National Plan Goal		Year					
		2011	**2012**	**2013**	**2014**	**2015**	**Total**
Critically review current knowledge of disease management and subsequently identify knowledge gaps and research needs related to WNS	Staff Time (Hours)	100	500	500	500	400	2,100
	Budget (Dollars)	0	0	0	0	0	0
Reduce the potential impacts associated with human visitation	Staff Time (Hours)	1,800	5,000	5,000	5,000	5,000	21,800
	Budget (Dollars)	$60,000	$200,000	$200,000	$200,000	$200,000	$860,000
Reduce inters-/intra-specific transmission and disease spread	Staff Time (Hours)	1,000	7,500	7,500	7,500	7,500	31,000
	Budget (Dollars)	$25,000	$120,000	$130,000	$130,000	$130,000	$535,000
Reduce environmental transmission to and from bats	Staff Time (Hours)	2,000	2,500	2,500	2,500	2,500	12,000
	Budget (Dollars)	$70,000	$150,000	$150,000	$150,000	$150,000	$670,000
Eliminate *P. destructans* from infected individuals	Staff Time (Hours)	1,000	4,000	4,000	4,000	4,000	17,000
	Budget (Dollars)	$160,000	$450,000	$450,000	$450,000	$450,000	$1,960,000
Identify and limit adverse ecological impacts of management actions, including decontamination techniques, to acceptable limits	Staff Time (Hours)	300	1,300	1,300	1,300	1,300	5,500
	Budget (Dollars)	0	0	$200,000	$200,000	$200,000	$600,000

Total	Staff Time (Hours)	6,200	20,800	20,800	20,800	20,800	89,400
	Budget (Dollars)	$315,000	$920,000	$1,130,000	$1,130,000	$1,130,000	$4,625,000

Etiology, Epidemiological and Ecological Research Implementation Plan for The National Plan for Assisting States, Federal Agencies, and Tribes in Managing White-Nose Syndrome in Bats

2011-2015

Submitted by: _____ Date: _____
Sybill K. Amelon, USFS
Etiology, Epidemiological and Ecological Research Working Group Leader

Approved by: _____ Date: _____
Jeremy Coleman, USFWS
National White-nose Syndrome Coordinator

TABLE OF CONTENTS

EXECUTIVE SUMMARY

The *National Plan for Assisting States, Federal Agencies and Tribes in Managing White-Nose Syndrome in Bats* provides a strategic framework for the investigation and management of this disease. Its implementation uses working groups to address seven critical elements of the investigation effort, one of which includes Etiology, Epidemiological and Ecological Research. This strategic framework identifies major goals and key action items within each of these elements for a collaborative, continental effort to address this emerging infectious disease of North American cave bats.

The Etiology, Epidemiological and Ecological Research Working Group is responsible for developing an effective plan for research on relevant aspects of bat ecology and behavior, diagnostic methods, pathology, epidemiology of the disease, presence and persistence of the causative agent in the environment and risks posed to bats and other species. It establishes criteria for use in prioritizing epidemiological and ecological research activities. This implementation plan a dynamic document for use by state, federal and tribal agencies that will be periodically reviewed and updated by members of the Etiology, Epidemiological and Ecological Research Working Group to incorporate anticipated advancements made by scientists and field biologists.

LIST OF PREPARERS

Sybill Amelon, USDA Forest Service, Northern Research Station
Vishnu Chaturvedi, Wadsworth Center, NYSDOH
Winifred Frick, University of California, Santa Cruz
Megan Friggans, USDA Rocky Mountain Research Station
Tom Ingersoll, NIMBIOS, TN
Kevin Keel, Southeastern Cooperative Wildlife Disease Study; College of Veterinary Medicine, UGA
Lynn Kleina, NSS, Perkasie, PA
Guy Knudsen, University of Idaho
Dan Lindner, USDA Forest Service, Northern Research Station
Roger Perry, USDA Forest Service Southern Research Station
Alison Robbins, Cummings School of Veterinary Medicine
Amy Russell, Grand Valley State University
Robin E. Russell, USGS National Wildlife Health Center
Brett Tyler, Virginia Bioinformatics Institute, Virginia Tech
Michelle Verant, USGS National Wildlife Health Center

Background

E.1. Overview

Bats have important roles in many ecosystems and provide economic benefit as predators of nocturnal agricultural and forest insects (Kunz et al. 2011). Declining populations of this diverse mammalian group have been a concern of resource management and conservation agencies worldwide for several years (Hutson et al. 2001, Kunz and Racey 1998). The reasons for these declines are diverse but since 2006, a disease epidemic (white-nose syndrome, WNS) associated with the fungal pathogen *Geomyces(*now *Pseudogymnoascus*) *destructans* (Gargas et al. 2009, Lorch et al. 2011) has resulted in high mortality. Recent estimates by U.S. Fish and Wildlife Service biologists and partners suggest mortality is at least 5.7 million to 6.7 million bats (USFWS 2012). The disease is anticipated to continue to spread; therefore, potential ecological and economic consequences to forest and agricultural systems is estimated to be extremely high as well (Boyles et al. 2011).

Although state, federal, academic and non-government organization researchers have worked collaboratively to increase understanding of WNS since its discovery, there are significant knowledge gaps regarding the fundamental dynamics and ecology of this disease. Effective response requires an understanding of the interactions among the pathogen, its host(s), and the environment; knowledge gaps in these areas impede the development of plans to control and mitigate the disease. To facilitate collaboration and coordination, the *National Plan for Assisting States, Federal Agencies and Tribes in Managing White-Nose Syndrome in Bats* (*National WNS Plan)* was developed (http://www.fws.gov/WhiteNoseSyndrome/pdf). The *National WNS Plan* provides a strategic framework for research and management of WNS, including key action items and the role(s) of agencies and entities involved in the North American effort. An organizational structure has been proposed by an inter-agency WNS executive committee (Appendix A), including policy, oversight, research, and management levels. The research and management levels include working groups through which on-the-ground research, monitoring and management will be facilitated. Information on members of this working group is in Appendix B and specific goals and action items are described in detail in Appendix C.

Roles and Responsibilities

ETIOLOGY, EPIDEMIOLOGY AND ECOLOGICAL RESEARCH WORKING GROUP (EEERWG) ROLES AND RESPONSIBILITIES

The purpose of this working group is to identify critical ongoing research needs relating to the cause, origin, transmission, pathogenesis, and impact of WNS on bats and the environment. The term epidemiology has been widely applied to cover not only epidemic disease but has been used in the context of non-disease health conditions as well. Therefore, for clarity, the EEERWG has provided a glossary of epidemiological terms that are used in this document and epidemiological research in general for use as a reference tool for the WNS strategic community (Appendix D). In the context of WNS, we define epidemiology as "the study of the *distribution* and *determinants* of disease in specified populations, and the application of this study to the control

of disease". *Distribution* refers to the frequency and pattern of disease-related characteristics in a population while *determinant* refers to any factor, whether event, characteristic, or other definable entity, that brings about change in a disease. Inherent in epidemiology is the principle that the distribution of occurrence of a disease in a population is governed by the interaction of a large number of different factors or determinants.

Epidemiology is essentially the identification and evaluation of these interactions to propose potential means to manipulate some of the determinants involved and in doing so reduce the frequency with which the disease in question occurs in a population. Determinants can be broadly classified as being either intrinsic or extrinsic in nature. Intrinsic determinants are generally determined genetically and refer to physical or physiological characteristics of the host or disease agent (or intermediate host, vector, or reservoir, if present). Extrinsic determinants are normally associated with some form of environmental influence on the host or disease agent (or intermediate host, vector, or reservoir, if present). They may also include interventions made by humans into the disease process by the use of treatments, movement, and quarantines. Developmental determinants are the result of interactions between intrinsic and extrinsic factors.

Since the definition of epidemiology is comprehensive, it encompasses many goals and objectives of other working groups as well as EEERWG. Throughout this document, we will attempt to identify and clarify those areas where our goals and objectives coincide or overlap with other working groups and how we envision the research focus of our working group to complement the management focus of the other groups.

IMPLEMENTATION STRATEGY

The purpose of this *Etiology, Epidemiology and Ecological Research Implementation Plan* is to outline specific actions needed to achieve the strategic direction in the *National WNS Plan*. At this time, subgroups of EEERWG have not been designated. As membership of the EEERWG grows and/or additional needs are determined, the establishment of sub-working groups is anticipated.

Since the determinants of disease are often varied, multiple scientific research disciplines and techniques are needed to holistically produce a composite and comprehensive picture of how a disease maintains itself in nature. If we accept the premise that the frequency with which a disease occurs in a population is dynamic and governed by a large number of determinants, it would be expected that some of these, particularly the extrinsic ones, would vary spatially and temporally. The effective control of disease depends on a thorough understanding of the many complex factors that govern the interactions taking place.

Current known research projects and products are available on the USFWS website; members of EEERWG will seek to stay abreast of new research products that may be of importance to the WNS Research Community and forward new materials for posting on the website. While progress has been made, particularly in disease etiology (Lorch et al. 2011), research is still needed on relevant aspects of bat ecology and behavior, diagnostic methods, pathology, epidemiology of the disease, presence and persistence of the causative agent in the environment, and risks posed to bats and other species. This research is anticipated to be conducted through

partnerships among academic entities, non-government organizations, and State and Federal agencies. New information may shift priorities and reveal new areas of investigation. Therefore, an effective process for coordinating research and sharing information is also required.

E.2. GOALS AND ACTION ITEMS

Goal 1: Critically review current knowledge of epidemiology and ecology of WNS to identify knowledge gaps and research needs.

Action Items:

1. Conduct in-depth literature review of current published WNS specific research and expert opinion; synthesize existing information available that could be applied to new or unaddressed questions. (e.g. lab results, models developed, assay procedures, landscape data useful for modeling).
2. Conduct in-depth literature review of related research and synthesize to be applied to new or unaddressed questions.
3. Develop conduit for sharing data.
4. Identify priority research questions.

Goal 2: Establish disease etiology**.**

Action Items:

1. Investigate the biology/ecology *of P.destructans* and its role in WNS
2. Continue to consider evidence and investigate other potential synergistic and/or predisposing agents for the suite of WNS signs/symptoms observed in bats.

Goal 3: Enhance understanding of WNS pathogenesis.

Action Items:

1. Develop tools to facilitate investigations of pathogenesis (for example, developing suitable animal models or tissue culture).
2. Investigate the origins and evolution *of P. destructans*.
3. Develop methods and protocols for understanding pathogenesis of WNS.

Goal 4: Enhance understanding of WNS epidemiology and transmission - interactions of pathogen, host ecology, and environment.

1. Investigate the growth, survival and persistence *of P. destructans*.
2. Investigate whether other animal taxa are involved with the disease process.
3. Investigate bat species and population differences in severity of WNS.
4. Collect epidemiological data.

5. Develop standardized collection protocols for data on distribution, prevalence, incidence, case-fatality rates

Goal 5: Evaluate the ecological and economic consequences of WNS.

Action Items:

1. Collect data on contributions of bats to cave ecosystems (a) before WNS (where applicable) and (b) after WNS (where applicable).
2. Quantify impact on recreational activities.
3. Quantify impact of management activities on cave ecosystems.
4. Collect and analyze data for ecosystem services of bats.
5. Develop economic model(s) based on quantified information by region to assess direct and indirect economic impacts.

Goal 6: Synthesize the knowledge gained in Goals 1- 5 into useful predictive models that identify sensitivities in the epizootic process.

1. Develop predictive models and sensitivity analysis of epizootic process based on knowledge synthesis.

MONITORING AND EVALUATION OF THE IMPLEMENTATION PLAN

The Etiology, Epidemiological and Ecological Working Group leader will assemble the working group members, as necessary, via conference call, video conference, webinar, or other technology. When possible, the Etiology, Epidemiological and Ecological Working Group will convene during the annual WNS Symposium to review the implementation plan.
This Etiology, Epidemiological and Ecological Implementation Plan will be reviewed quarterly (January, April, July, October) by the Etiology, Epidemiological and Ecological Working Group and working group leadership (group leader and subgroup leads) and updated as needed.
Requests to amend the Implementation Plan or specific products will be directed through the Etiology, Epidemiological and Ecological Working Group leader. Members of the working group will have an opportunity to comment on proposed revisions during a comment period after which there will be voting among the membership to accept or reject the revisions based on simple majority. Updates to the Etiology, Epidemiological and Ecological Implementation Plan or products generated from this document will be forwarded to the National WNS Coordinator and Communications Working Group for dissemination.
Updates to the Etiology, Epidemiological and Ecological Implementation Plan will be forwarded to the WNS Coordinators, steering committee and other working group leaders for approval.

APPENDIX 1. ETIOLOGY, EPIDEMIOLOGICAL AND ECOLOGICAL WORKING GROUP CONTACTS

Etiology, Epidemiological and Ecological Working Group Leader
The leader is responsible for pulling the membership together, as needed, to implement, evaluate and update the *Etiology, Epidemiological and Ecological Implementation Plan*. The leader will serve with the WNS coordinators and other working group leads to provide recommendations to the steering committee and prioritize research needs.

Sybill Amelon, Research Wildlife Biologist
USDA Forest Service, Northern Research Station
202 Nat. Res. Bldg.; UMC
Columbia, MO
(573) 875-5341 ext 231 (office)
samelon@fs.fed.us

Working Group Members

Name	E-mail	Agency/Organization
Amanda Janicki	ajanicki@utk.edu	University of TN-Knoxville
Marm Kilpatrick	akilpatr@ucsc.edu	University of CA—Santa Cruz
Alison Robbins	Alison.Robbins@tufts.edu	Cummings School of Veterinary Medicine
Brett Tyler	btyler@vbi.vt.edu	Virginia Bioinformatics Institute, Virginia Tech
Craig Willis	c.willis@uwinnipeg.ca	University of Winnipeg
LeAnn White	clwhite@usgs.gov	USGS National Wildlife Health Center
Dan Lindner	dlindner@fs.fed.us; dlindner@wisc.edu	USDA FS, Northern Research Station
Don Campton	don_campton@fws.gov	U.S. Fish & Wildlife Service
Emma Pelton	emma.pelton@wi.gov	WDNR
Evan Pannkuk	evan.pannkuk@smail.astate.edu	Arkansas State University
Hazel Barton	hazel@cavescience.com	Northern Kentucky University
Hugh Broders	hugh.broders@smu.ca	
Jeff Foster	jeff.foster@nau.edu	Northern Arizona University
James Turner	jm.turner@uwinnipeg.ca	University of Winnipeg
Karen Blejwas	Karen.bejwas@alaska.gov	Alaska Dept. Fish & Game
Kevin Castle	kevin_castle@nps.gov	National Park Service
Karen Vanderwolf	kjvanderw@gmail.com	Karen Vanderwolf
Kate Langwig	klangwig@bu.edu	Boston University & UC Santa Cruz
Lisa Powers	lpowers@illinois.edu	University of Illinois

Lynn Kleina	lynnkleina@yahoo.com	NSS, Perkasie, PA
Megan Friggans	meganfriggens@fs.fed.us	USDA Rocky Mountain Research Station
Kevin Keel	mkkeel@uga.edu	Southeastern Cooperative Wildlife Disease Study; College of Veterinary Medicine, UGA
Marianne Moore	msm035@buknell.edu	Bucknell University
Riley Bernard	rbernar3@utk.edu	University of TN-Knoxville
Robin Russell	rerussell@usgs.gov	USGS
Roger Perry	rperry03@fs.fed.us	USDA FS, Southern Research Station
Amy Russel	russelam@gvsu.edu	Grand Valley State University
Tina Cheng	tinazilla@gmail.com	University of CA—Santa Cruz
T.J. Miller	TJ_Miller@fws.gov	U.S. Fish & Wildlife Service
Tom Ingersoll	tomingersoll@nimbios.org, tomingersoll@yahoo.com	NIMBIOS, TN
Vishnu Chaturvedi	Vishnu@wadsworth.org	Wadsworth Center, NYSDOH
Winifred Frick	wfrick@ucsc.edu	University of CA—Santa Cruz

APPENDIX 2. ETIOLOGY, EPIDEMIOLOGICAL AND ECOLOGICAL RESEARCH ACTIVITY SCHEDULE, 2012-2015

The following tables highlight activities necessary to conduct Epidemiological and Ecological Research for the period 2012-2015. In many cases, members of the Etiology, Epidemiological and Ecological Research Working Group will contribute their expertise to coordinate meetings and develop protocols or products. In some cases, it will be necessary for federal, state, and tribal natural resource agencies to take a lead role in implementing protocols or in utilizing databases or products. Estimates for timeframes and budgets will be reviewed annually and updated.

Goal 1: Critically review current knowledge of epidemiology and ecology of WNS to identify knowledge gaps and research needs.

Action No./ Task No.	Activity	Lead	Required Expertise	Review	Relative Order	Est. Timeframe	Estimated Budget & Status	In Progress
Action Item 1.1: Conduct in-depth literature review of current published WNS specific research and expert opinion; synthesize existing information available that could be applied to new or unaddressed questions. (e.g., lab results, models developed, assay procedures, landscape data useful for modeling).								
1.1.1	Produce a peer-reviewed review publication(s) as synthesis product of 1.1 and 1.2.	EEERWG		N/A	1	2012	$5,000 + Staff time (300 hrs)	X
Action Item 1.2: Conduct in-depth literature review of related research and synthesize to be applied to new or unaddressed questions.								
1.2.1	Plant Pathology literature.	Knudsen		N/A	1	2012	$5,000 + Staff time (200 hrs)	X
1.2.2	Animal Pathology literature.	Amelon/Robbins		N/A	1	2012	$5,000 + Staff time (200 hrs)	X
1.2.3	Fungi and Medical Mycology literature.	Verant/Lindner	APHIS and/or other disease mgt agencies	N/A	1	2012	$5,000 + Staff time (200 hrs)	X

1.2.4	Epidemiology and Disease Modeling literature.	Ingersoll/R. Russell		N/A	1	2012	$5,000 + Staff time (200 hrs)	X
Action Item 1.3: Develop conduit for sharing data								
1.3.1	Develop means to communicate on-going results within the WNS research community.	EEERWG COMWG LIAISON	Need to work with Data Management WG to facilitate data exchange	N/A	1	2012 - 2015	$200,000 + Staff time (or Post Doc) (200 hrs)[2] 40 hrs annually after established	
Action Item 1.4: Establish and maintain a list of prioritized research needs and work closely with other working groups to see that high priority needs are communicated and/or addressed.								
1.4.1	Quarterly review research questions to incorporate new information.	EEERWG		March, June, September, December	1	2012 - 2015	Staff time (80 hrs) annually	X
1.4.2	Participate in WNS-related meetings and conferences to report accomplishments and findings to obtain new conservation and recovery information needs, and to interact with other working groups.	EEERWG		Annually	1	2012 - 2015	Staff time (40 hrs/member) annually	Funded in-kind by agencies
[2]-- **$** May overlap with Data Management estimates; staff time represents EEERWG inputs								

Goal 2: Establish disease etiology.

Action No./ Task No.	Activity	Lead	Required Expertise	Review	Relative Order	Est. Timeframe	Estimated Budget & Status	In Progress
Action Item 2.1: Investigate P. destructans and establish its role as causal agent of WNS.								
2.1.1	Several studies on this issue have produced peer-reviewed publications. Refer to Literature Citations.	EEERWG		N/A	0	2011-2012		Largely completed
Action Item 2.2: Continue to consider evidence and investigate other potential synergistic and/or predisposing agents for the suite of WNS signs/symptoms observed in bats.								
2.2.1	Evaluate mycotoxins, pesticides and other environmental contaminants.	EEERWG	Biochemistry/contaminants	N/A	1	2013 - 2015	$300,000 per study+ Staff time (200 hrs.)[2] 160 hrs annually after initial studies established	At least one study completed; additional work needed
2.2.2	Evaluate and model potential synergistic effects of environmental conditions.	EEERWG	Hierarchical modelers/climate change researchers		1	2012 - 2015	$300,000 per study + Staff time (200 hrs.)[2] 160 hrs. annually after initial studies established	At least one study initiated; additional work needed
2.2.3	Investigate other potential vectors or reservoirs including other vertebrates and invertebrates.	EEERWG	Entomologists/herpetologists	N/A	2	2013 - 2015	$300,000 + Staff time (200 hrs.)[2] 160 hrs. annually after initial studies established	No known studies

Action No./ Task No.	Activity	Lead	Required Expertise	Review	Relative Order	Est. Timeframe	Estimated Budget & Status	In Progress
Action Item 3.1: Develop tools to facilitate investigations of pathogenesis (for example, developing suitable animal models or tissue culture).								
3.1.1	Describe,categorize existing or develop needed molecular tools to investigate pathogen factors.	EEERWG/ Partners	Specialized molecular Biologists up to 4 studies needed	N/A	1	2012 - 2014	$500,000/per study + Staff time (100 hrs.)	X
3.1.2	Describe and categorize existing or develop needed molecular, sampling or other tools to investigate host factors.	EEERWG/ Partners	Immunologists and experts in proteomics	N/A	1	2012 - 2014	$500,000 + Staff time (200 hrs.)	
3.1.3	Develop handbook of molecular protocols.	EEERWG/ Partners		Annually	2	2012 - 2014	$30,000 + Staff time (400 hrs.)	
Action Item 3.2: Investigate the origins and evolution of P. destructans.								
3.2.1	Study near neighbor relatives of P. d.	Lindner		N/A	1	2012	$350,000+ Staff time (80 hrs.)	X
3.2.2	Phylogeography of P. d.	A. Russell		N/A	1	2012	$200,000 + Staff time (80 hrs.)	X
Action Item 3.3: Develop methods and protocols for understanding pathogenesis of WNS.								
3.3.1	Investigate P. d. infectivity and virulence factors	EEERWG/ Partners	Proteomics	N/A	1	2012 - 2014	$500,000 per study (>=2) + Staff time (200 hrs.)	
3.3.2	Investigate host(s) resistance and tolerance factors.	EEERWG/ Partners	Proteomics, animal behavior and physiology	N/A	1	2012 - 2014	$500,000 per study (>= 3) + Staff time (200 hrs.)	

Goal 4: Enhance understanding of WNS epidemiology and transmission - interactions of pathogen, host ecology, and environment.

Action No./ Task No.	Activity	Lead	Required Expertise	Review	Relative Order	Est. Timeframe	Estimated Budget & Status	In Progress
Action Item 4.1: Investigate the growth, survival and persistence of G. destructans.								
4.1.1	Investigate life cycle and range of environmental growth/viability conditions, seasonal persistence and limits of fungus viability.	Verant/others	Molecular Biology and Chemistry	N/A	1	2012 - 2014	$200,000 + Staff time (200 hrs.) 40 hrs. annually after established	X
4.1.2	Investigate techniques for disinfection and control to inform management practices.	Barton/others	Molecular biology and chemistry	N/A	1	2012 - 2014	$200,000 + Staff time (200 hrs.) 40 hrs. annually after established	X
Action Item 4.2: Investigate whether other animal taxa are:								
4.2.1	Susceptible to P.d.	EEERWG		N/A	2	2013-2015	$280,000 + Staff time (160 hrs.)	X
4.2.2	Vectors or otherwise associated with WNS transmission.	EEERWG		N/A	2	2013-2015	$280,000 + Staff time (160 hrs.)	
Action Item 4.3: Investigate bat species and population differences in severity of WNS.								
4.3.1	Develop quantitative methods to measure population sizes pre, during and post disease by demographic groups.	EEERWG/ CRWG	Population modelers/ Data Mgt WG	N/A	1	2012 - 2014	$800,000 + Staff time (200 hrs.) 160 hrs. annually after established	X

4.3.2	Develop protocols for data collection of susceptible, exposed, infected, recovered and/or carrier states for epidemiology models.	EEERWG/ Partners	Epidemiologists	N/A	1	2012-2013	$150,000 + Staff time (200 hrs.) 100 hrs. annually after established	X
4.3.4	Coordinate with Conservation and Recovery Working Group.	EEERWG LEAD; Amelon Liaison CRWG		N/A		2012 - 2015	Staff time (160 hrs.) annually	X
Action Item 4.4: Collect epidemiological data.								
4.4.1	Convene Epidemiology workshops to provide information on	EEERWG		N/A	1	2013	$30,000 + Staff time (160 hrs.)	
4.4.1a	Standardized data collection protocols	EEERWG		Annually	2	2013-2015	$30,000 + Staff time (160 hrs.)	
4.4.1b	Use of collected data in epidemiological models	EEERWG		Annually	2	2013-2015	$30,000 + Staff time (160 hrs.)	
Action Item 4.5: Develop standardized collection protocols for data on distribution, prevalence, incidence, case-fatality rates								
4.5.1	Use information acquired in 4.1 - 4.4 to model the mechanisms and timing of transmission of P. d.	EEERWG (Keel/Chaturvedi)/ Partners	Molecular biology and epidemiology and statistics	N/A	1	2013-2015	$280,000 + Staff time (160 hrs.)	X
4.5.2	Coordinate with Diagnostics, Disease Surveillance and Disease Management Working Groups	Verant-DX Liaison; Ingersoll - Sur. Liaison; R. Russell DisMgt Liaison		N/A	1	2012 - 2015	Staff time (160 hrs.) annually	X

Goal 5: Evaluate the ecological and economic consequences of WNS

Action No./ Task No.	Activity	Lead	Required Expertise	Review	Relative Order	Est. Timeframe	Estimated Budget & Status	In Progress
Action Item 5.1: Collect data on contributions of bats to cave ecosystems (a) before WNS (where applicable) and (b) after WNS (where applicable)								
5.1.1	Quantify nutrient composition and volume of guano.	EEERWG	Biochemists	N/A	1	2013-2015	$300,000 + Staff time (200 hrs.)	
5.1.2	Quantify Microflora and microfauna.	EEERWG	Microbiologists, mycologists	N/A	2	2013-2015	$300,000 + Staff time (200 hrs.)	
5.1.3	Quantify Obligate cave organisms.	EEERWG	Microbiologists, mycologists herpetologists, entomologists	N/A	2	2013-2015	$100,000 + Staff time (160 hrs.)	
5.1.4	Quantify Pathogen foragers.	EEERWG	Microbiologists, mycologists herpetologists, entomologists	N/A	1	2013-2015	$100,000 + Staff time (160 hrs.)	
Action Item 5.2: Quantify impact on recreational activities?								
5.2.1	Coordinate with NSS and other disciplines to develop criteria for measurement.	EEERWG	Cave users	N/A	2	2013-2015	Staff time (240 hrs.)	
Action Item 5.3: Quantify impact of management activities on cave ecosystems?								
5.3.1	Convene a team from representative agencies to develop criteria for measurement.	EEERWG	Managers	N/A	2	2013-2015	$30,000 + Staff time (160 hrs.)	

Action Item 5.4: Collect and analyze data for ecosystem services of bats:								
5.4.1	Gather information from existing data (ARS, EPA, USDA) on forest and agricultural ecosystems and public health considerations.	EEERWG	ARS, EPA, USDA	As new data becomes available	1	2012-2014	$370,000 + Staff time (320 hrs.)	X
5.4.2	Assess the trophic cascade from dramatic loss of insectivorous bat populations, with an emphasis on impacts to forestry, agriculture, and public health.	EEERWG	Ecologists, economists	N/A	1	2012-2014	$150,000 + Staff time (200 hrs.)	
Action Item 5.5: Develop economic model(s) based on quantified information by region to assess direct and indirect economic impacts								
5.5.1	Develop interactive economic model program that can be modified regionally to assess economic impacts.	EEERWG	Economists	As new data becomes available	1	2012-2015	$150,000 + Staff time (200 hrs.)	X

Goal 6: Synthesize the knowledge gained in Goals 1- 5 into useful predictive models that identify sensitivities in the epizootic process.

Action No./ Task No.	Activity	Lead	Required Expertise	Review	Relative Order	Est. Timeframe	Estimated Budget & Status	In Progress
Action Item 6.1: Develop predictive models and sensitivity analysis of epizootic process based on knowledge synthesis.								
6.1.1	Identify through research and adaptive management, disease stages or factors that may be amenable to mitigation or management strategies.	EEERWG		As new data becomes available	1	2013-2015	$150,000 + Staff time (200 hrs.)	

APPENDIX 3: BUDGET SUMMARY BY GOAL

WNS National Plan Goal		Year				
		2012	2013	2014	2015	Total
Goal 1: Critically review current knowledge of epidemiology and ecology of WNS to identify knowledge gaps and research needs	Staff Time (Hours)	800	400	200	200	1,600
	Budget (Dollars)	$225,000	$200,000	$200,000	$200,000	$825,000
Goal 2: Establish disease etiology	Staff Time (Hours)	400	400	400	400	1,600
	Budget (Dollars)	$200,000 - $600000	$200,000 - $600000	$200,000 - $600000	$200,000 - $600000	$800,000 - 2,400,000
Goal 3: Enhance understanding of WNS pathogenesis	Staff Time (Hours)	360 - 500	160 - 500	160 - 500	160 - 500	840 - 2000
	Budget (Dollars)	$500,000 - 775,000	$500,000 - 1,500,000	$500,000 - 1,500,000	$500,000 - 1,500,000	$2,000,000 - 5,275,000
Goal 4: Enhance understanding of WNS epidemiology and transmission - interactions of pathogen, host ecology and environment	Staff Time (Hours)	300	700	400	200	1,600
	Budget (Dollars)	$200,000	$1,600,000 - 2,000,000	$500,000 - 775,000	$200,000 - $600000	$2,500,000 - 3,300,000
Goal 5: Evaluate the ecological and economic consequences of WNS	Staff Time (Hours)	600	1,200	1,400	800	4,000
	Budget (Dollars)	$500,000 - 775,000	$1,000,000- $1,500,000	$1,000,000- $1,500,000	$200,000 - 575,000	$1,700,000- $4,350,000
Goal 6: Synthesize the knowledge gained in Goals 1- 5 into useful predictive models that identify sensitivities in the epizootic process	Staff Time (Hours)	0	160	160	320	640
	Budget (Dollars)	$0	$150,000	$150,000	$300,000	$600,000
Total	Staff Time (Hours)	1,700	2,660	2,560	1,900	8,820
	Budget (Dollars)	$1,200,000- $2,500,000	$3,500,000- $5,000,000	$2,500,000- $4,000,000	$1,000,000- $2,500,000	$8,000,000- $14,000,000

APPENDIX 4. LITERATURE CITED

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Disease Surveillance Implementation Plan for The National Plan for Assisting States, Federal Agencies, and Tribes in Managing White-Nose Syndrome in Bats

2011-2015

Submitted by: _____ Date: _____

Eric Britzke, U.S. Army Engineer Research and Development Center, Leader
Disease Surveillance Working Group

Approved by: _____ Date: _____

Jeremy Coleman, USFWS
National White-nose Syndrome Coordinator

TABLE OF CONTENTS

LIST OF PREPARERS

Anne Ballmann, National Wildlife Health Center
Eric Britzke, U.S. Army Engineer Research and Development Center
Tom DeLiberto, USDA Animal and Plant Health Inspection Service
Rita Dixon, Idaho Department of Fish and Game
Chris Dobony, U.S. Army Fort Drum
Tony Elliott, Missouri Department of Conservation
Rich Geboy, U.S. Fish and Wildlife Service
Michael Herder, Bureau of Land Management
Tom Ingersoll, National Institute for Mathematical and Biological Synthesis
Andy King, U.S. Fish and Wildlife Service
Angie McIntire, Arizona game and Fish Department
Pat Ormsbee, U.S. Forest Service
Rick Reynolds, Virginia Game and Inland Fisheries
Tom Rodhouse, National Park Service
Michelle Verant, National Wildlife Health Center
Alison Whitlock, U.S. Fish and Wildlife Service

IMPLEMENTATION STRATEGY

DISEASE SURVEILLNCE WORKING GROUP ROLES AND RESPONSIBILITIES

The Disease Surveillance Working Group is responsible for developing an effective plan for WNS Disease Surveillance. It is important to make the distinction between WNS and *Pseudogymnoascus destructans* surveillance. While *P. destructans* causes WNS, this plan is developed to solely address WNS surveillance. Consequently, this plan will rely on the use of use of field signs (visible fungal growth, increased activity, etc.) to determine need for sample collection. Histopathology is the gold standard for WNS confirmation, thus sampling under this plan will be focused on submitting samples that can be examined using this diagnostic technique.

ASSESSING AND REVISING THE SURVEILLANCE IMPLEMENTATION PLAN

This plan is not a static document but will be revised as new information is obtained. Requests to amend the Implementation Plan or specific products will be directed through the working group leader. When necessary, the Disease Surveillance Working Group leader will assemble working group members via conference call, video conference, webinar, or other technology. Updates to the Disease Surveillance Implementation Plan or products generated from this document will be forwarded to the National WNS Coordinator and Communications Working Group for dissemination.

National WNS Plan Surveillance Goal and Action Items

Goal: Create a coordinated disease surveillance program nationwide that identifies and minimizes disturbance to bats and potential transmission risks while still enhancing early detection.

Action Items:

1. Develop and provide recommendations for coordinated disease surveillance.
    a. In known WNS-affected areas bat populations should be monitored to assess disease progression and effects of management actions.
    b. In areas outside the WNS-affected region surveillance should provide early detection of WNS, expansion from affected areas and new foci of WNS.
    c. In all areas surveillance should provide early detection of WNS in threatened and endangered and previously unaffected species.
2. Develop effective surveillance strategies based on disease risk and assist with implementation.
    a. Provide guidance for prioritizing sites.
    b. Determine appropriate sampling frames and sample sizes required to meet surveillance objectives.
3. Integrate surveillance efforts with those of other WNS working groups.

APPENDIX 1. DISEASE SURVEILLANCE ACTIVITY SCHEDULE

Action No./ Task No.	Activity	Lead	Required Expertise	Review	Relative Order	Est. Timeframe	Estimated Budget & Status
Action Item 1.1: Develop and provide recommendations for coordinated disease surveillance.							
1.1.1	Provide a framework for WNS surveillance that can be applied nationwide that focuses on providing detection of WNS in new species or new areas.		Annually	3rd	2011-2015	Staff Time (80 hrs.)	Not funded
Action Item 1.2: Develop effective surveillance strategies based on disease risk and assist with implementation.							
1.2.1	Develop a method for prioritizing sites for WNS surveillance that serves to focus resources on areas that might provide the best data on occurrence and spread.		Annually	1st	2011-2015	Staff Time (80 hrs.)	Not funded
1.2.2	Coordinate with the Diagnostics WG to provide guidance on the type of samples necessary for accurate WNS surveillance to provide unequivocal WNS confirmation.	Diagnostics WG	Annually	1st	2011-2015	Staff Time (80 hrs.)	Not funded

1.2.3	Coordinate with Diagnostics WG and regulatory agencies to establish sample sizes that maximize the chance of WNS detection, while minimizing the number of animals that must be submitted for analysis.		As needed based on new information	2nd	2011-2015	Staff Time (40 hrs.)	Not funded
1.2.4	Coordinate with Epidemiology WG on modeling disease risk of selected species and hibernacula.	Epidemiologists, disease modelers	As needed based on new information	3rd	2012	Staff Time (40 hrs.)	Not funded
Action Item: 1.3 Integrate surveillance efforts with those of other WNS working groups.							
1.3.1	Coordinate with the Communications and Outreach Working Group to provide guidance to federal, state and tribal natural resource agencies on how to conduct WNS surveillance.	Communications and Outreach WG	Annually	3rd	Ongoing	Staff time (40 hours / year)	Not funded
1.3.2	Revise protocols as results are obtained through the efforts of other working groups (i.e., Diagnostics, Epidemiology).	Diagnostics and Epidemiology WGs	As needed based on new information	4th	Ongoing	Staff time (120 hours/ year)	Not funded
1.3.3	Coordinate with the Data Management WG to ensure surveillance data is collected nationwide in a consistent and comparable format, thereby allowing for a more complete understanding of the occurrence and spread of WNS.	Data Management WG	Annually	3rd	Ongoing	Staff time (120 hours / year)	Not funded
1.3.4	Work with the Conservation and Recovery WG to help ensure that WNS surveillance be conducted simultaneously with population monitoring of hibernating bat species.	Conservation and Recovery WG: Population monitoring Subgroup	Annually	3rd	Ongoing	Staff time (240 hours / year)	Not funded

APPENDIX 2. BUDGET SUMMARY BY GOAL

WNS National Plan Goal		Year					
		2011	**2012**	**2013**	**2014**	**2015**	**Total**
Create a coordinated disease surveillance program nationwide that identifies and minimizes disturbance to bats and potential transmission risks while still enhancing early detection.	Staff Time (Hours)	840	840	840	840	840	4,200
	Budget (Dollars)	0	0	0	0	0	0

Conservation and Recovery Implementation Plan for The National Plan for Assisting States, Federal Agencies, and Tribes in Managing White-Nose Syndrome in Bats

2011-2015

Submitted by: _____ Date: _____
Robyn Niver, USFWS
Conservation and Recovery Working Group Leader

Approved by: _____ Date: _____
Jeremy Coleman, USFWS
National White-nose Syndrome Coordinator

TABLE OF CONTENTS

EXECUTIVE SUMMARY

The *National Plan for Assisting States, Federal Agencies, and Tribes in Managing White-Nose Syndrome in Bats* provides a strategic framework for the investigation and management of this disease. Its implementation uss working groups to address seven critical elements of the investigation effort, one of which includes Conservation and Recovery. This strategic framework identifies major goals and key action items within each of these elements for a collaborative, continental effort to address this emerging infectious disease of North American cave bats.

The Conservation and Recovery Working Group is responsible for developing an effective plan for monitoring populations of bat species that are or may be affected by white-nose syndrome. It will establish criteria for use in prioritizing conservation and management activities, and will describe best practices and techniques for the conservation and recovery of affected species. This implementation plan is meant to be a dynamic document for use by state, federal and tribal agencies. It will be periodically reviewed and updated by members of the Conservation and Recovery Working Group to incorporate anticipated advancements made by scientists and field biologists.

LIST OF PREPARERS

The following people served on the Conservation and Recovery Working Group writing team to develop this implementation plan between May 2011 and July 2012:

Ed Arnett, Theodore Roosevelt Conservation Partnership
Eric Britzke, U. S. Army Engineer Research and Development Center
Robert Brooks, USDA Forest Service
Emily Preston, New Hampshire Fish and Game Department
Scott Darling, Vermont Fish and Wildlife Department
Steve Thomas, National Park Service
Rebecca Ewing, USDA Forest Service
Cory Holliday, The Nature Conservancy
Joe Kath, Illinois Department of Natural Resources
Susan Loeb, USDA Forest Service
Robyn Niver, U. S. Fish and Wildlife Service
Lori Pruitt, U. S. Fish and Wildlife Service
Noelle Rayman, U. S. Fish and Wildlife Service
Rob Tawes, U. S. Fish and Wildlife Service
Susi von Oettingen, U. S. Fish and Wildlife Service

IMPLEMENTATION STRATEGY

CONSERVATION AND RECOVERY WORKING GROUP ROLES AND RESPONSIBILITIES

The Conservation and Recovery Working Group is responsible for developing an effective plan for monitoring populations of bat species that are or may be affected by WNS, establishing criteria for prioritizing conservation and management activities and describing best practices and techniques for the recovery of species of conservation concern that have been or may be affected by WNS.

The Conservation and Recovery Working Group is organized into three subgroups, each of which are focused on different goals and actions identified in the *National Plan for Assisting States, Federal Agencies, and Tribes in Managing White-Nose Syndrome in Bats (National WNS Plan).*

1. Population Monitoring Subgroup - Develops statistically robust monitoring protocols to be used by state, federal and tribal agencies to assess the effects of WNS on bat populations and the effectiveness of disease control and conservation efforts. This subgroup will focus on *National WNS Plan* Goals 1 and 4.

2. Species Conservation Subgroup – Identifies and promotes research and management among state, federal and tribal agencies to conserve species (and their habitats) known to be susceptible to WNS, primarily in areas where the disease has yet to affect bat populations. This subgroup will focus on *National WNS Plan* Goals 2, 3 and 4.

3. Species Recovery Subgroup – Identifies and promotes research and management actions among state, federal and tribal agencies to recover federally listed species affected by or susceptible to WNS, to reverse declining population trends in areas where WNS has decimated bat populations, and to restore hibernacula infected by *P. destructans*. This subgroup will focus on *National WNS Plan* Goals 2, 3 and 4.

Contact information for the working group leader and subgroup leaders are provided in Appendix 1. These individuals will serve as a team to oversee the implementation of this plan. The subgroups and entire Conservation and Recovery Working Group (Appendix 2) will convene periodically to review and report accomplishments and to reprioritize future efforts.

To ensure information and accomplishments are shared in a timely manner between the working groups, a communications liaison from the Communications and Outreach Working Group has been assigned to the Conservation and Recovery Working Group (Appendix 1).

CONSERVATION AND RECOVERY ACTIVITY SCHEDULE

Four strategic goals, along with several action items, were identified in the *National WNS Plan* for the conservation and recovery of bat populations and species affected by WNS. These goals and action items were used as the starting point for developing and prioritizing the Conservation and Recovery Activity Schedule (see Appendix 3).

The Conservation and Recovery Activity Schedule represents the core of this implementation plan. It contains specific tasks, that when implemented, will help this working group move closer to achieving the *National WNS Plan* goals – that is, conserving and recovering species affected by WNS.

MONITORING AND EVALUATING THE CONSERVATION AND RECOVERY IMPLEMENTATION PLAN

The Conservation and Recovery Working Group leader will assemble the subgroup and/or working group members, as necessary, via conference call, video conference, webinar, or other technology.

The Conservation and Recovery Implementation Plan will be reviewed annually by the Conservation and Recovery Working Group leadership (group leader and subgroup leads) or when significant issues for consideration are brought to the attention of the working group leader. Requests to amend the Implementation Plan or specific products will be directed through the appropriate subgroup leader or the Conservation and Recovery Working Group leader. Members of the working group and/or subgroups will have an opportunity to comment on proposed revisions during a comment period after which there will be voting among the membership to accept or reject the revisions based on simple majority. Updates to the Conservation and Recovery Implementation Plan or products generated from this document will be forwarded to the National WNS Coordinator and Communications Working Group for dissemination.

APPENDIX 1. CONSERVATION AND RECOVERY WORKING GROUP LEADERSHIP CONTACTS

CONSERVATION AND RECOVERY WORKING GROUP LEADER

The working group leader is responsible for pulling the three subgroups together, as needed, to implement, evaluate and update the *Conservation and Recovery Implementation Plan*. The leader will involve the communications liaison in working group meetings and business, as necessary. The leader will serve on the Coordination Team with the WNS coordinators and other working group leads to provide recommendations to the steering committee and prioritize research needs.

Robyn A. Niver, Endangered Species Biologist
U.S. Fish & Wildlife Service
New York Field Office
3817 Luker Road
Cortland, NY 13045
(607) 753-9334 (office)
robyn_niver@fws.gov

SUBGROUP LEADERS

Population Monitoring Subgroup	***Species Conservation Subgroup Co-leaders***	***Species Recovery Subgroup***
Susan C. Loeb, Research Ecologist USDA Forest Service, Southern Research Station Department of Forestry and Natural Resources Clemson University Clemson, SC 29634 (864) 656-4865 (office) sloeb@fs.fed.us or sloeb@clemson.edu	**Cory Holliday,** Cave and Karst Program Manager The Nature Conservancy of Tennessee 862 Fort Blount Ferry Road Gainesboro, TN 38562 (615) 504-7427 (cell) cholliday@tnc.org **Jim Goodbar**, Senior Cave and Karst Resources Specialist USDOI Bureau of Land Management Washington Office (WO 250) 620 E. Greene St., Carlsbad, New Mexico 88220 (575) 234-5929 JGoodbar@blm.gov	**Robyn A. Niver,** Endangered Species Biologist U.S. Fish & Wildlife Service New York Field Office 3817 Luker Road Cortland, NY 13045 (607) 753-9334 (office) robyn_niver@fws.gov ***Captive Management Team*** **Rob Tawes** U.S. Fish & Wildlife Service Southeast Regional Office 1875 Century Boulevard Atlanta, GA 30345 (404) 679-7142 (office) robert_tawes@fws.gov

COMMUNICATIONS AND OUTREACH WORKING GROUP LIAISON

Katie Gillies
Bat Conservation International
P. O. Box 162603
Austin, TX 78716-2603
(512) 327-9721
kgillies@batcon.org

APPENDIX 2. CONSERVATION AND RECOVERY WORKING GROUP MEMBERSHIP

These individuals are recognized as members of the Conservation and Recovery Working Group (as of 2012). They intend to provide their time and expertise to maintain and help implement the activities listed within this plan. The Working Group leader will update them annually.

State Agencies

Erin Adams, Delaware Division of Fish and Wildlife
Alyssa Bennett, Vermont Fish and Wildlife Department
Emily Preston, New Hampshire Fish and Game Department
Scott Darling, Vermont Fish and Wildlife Department
John DePue, Maine Department of Inland Fisheries and Wildli
Rita Dixon, Idaho Department of Fish and Game
Tony Elliott, Missouri Department of Conservation
Dan Feller, Maryland Department of Natural Resources
Kim Hersey, Utah Division of Wildlife
Daryl Howell, Iowa Department of Natural Resources
Patrick Isakson, North Dakota Game and Fish Department
Scott Johnson, Indiana Department of Natural Resources
Heather Kaarakka, Wisconsin Department of Natural Resources
Rory Lamp, Nevada Department of Wildlife
Angie McIntire, Arizona Game and Fish Department
Trina Morris, Georgia Department of Natural Resources
Holly Niederriter, Delaware Division of Fish and Wildlife
Gerda Nordquist, Minnesota Department of Natural Resources
Rick Reynolds, Virginia Department of Game and Inland Fisheries
Lisa Schlenker, Wisconsin Department of Natural Resources
Gregor Schuurman, Wisconsin Department of Natural Resources
Craig Stihler, West Virginia Division of Natural Resources
Melissa Tucker, Florida Fish and Wildlife Conservation Commission

Federal Agencies

Eric Britzke, U.S. Army Engineer Research and Development Center
Robert Brooks, USDA Forest Service
Paul Cryan, U.S. Geological Survey
Chris Dobony, Department of Defense -Fort Drum
Barbara Douglas, U.S. Fish and Wildlife Service – WV Field Office
Laura Ellison, U.S. Geological Survey
Rebecca Ewing, USDA Forest Service
Jim Goodbar, BLM (Species Conservation Subgroup Co-leader)
Cathy Johnson, USDA Forest Service
Christina Kocer, U.S. Fish and Wildlife Service – Region 5
Dennis Krusac, USDA Forest Service
Susan Loeb, USDA Forest Service (Population Monitoring Subgroup Leader)
Paul McKenzie, U.S. Fish and Wildlife Service – Missouri Field Office
Robyn Niver, U.S. Fish and Wildlife Service (Working Group Leader)
Pat Ormsbee, USDA Forest Service
Lori Pruitt, U.S. Fish and Wildlife Service – Bloomington Field Office
Noelle Rayman, U.S. Fish and Wildlife Service – New York Field Office

Tom Rodhouse, National Park Service
Richard Stark, U.S. Fish and Wildlife Service – Oklahoma Field Office
Rob Tawes, U.S. Fish and Wildlife Service (Captive Management Team Leader)
Wayne Thogmartin, U.S. Geological Survey
Steve Thomas, National Park Service
Susi von Oettingen, U.S. Fish and Wildlife Service - New England Field Office

Non-governmental Agencies and Organizations
Katie Gillies, Bat Conservation International (Communications and Outreach Working Group Liaison)
Sylvia Fallon, Natural Resources Defense Council
Cory Holliday, The Nature Conservancy (Species Conservation Subgroup Co-leader)
Brent Sewall, Temple University
Justin Stevenson, National Wildlife Control Operator's Association

APPENDIX 3. CONSERVATION AND RECOVERY ACTIVITY SCHEDULE, 2011-2015

The following tables highlight activities necessary to monitor, conserve and recover species affected by or susceptible to WNS for the period 2011-2015. In many cases, members of the Conservation and Recovery Working Group will contribute their expertise to coordinate meetings and develop protocols or products. In some cases, it will be necessary for federal, state and tribal natural resource agencies to take a lead role in implementing protocols or in usining databases or products. Estimates for timeframes and budgets will be reviewed annually and updated.

Goal 1: Develop and validate rapid assessment monitoring plans to determine differences in susceptibility among species, and identify which species are most vulnerable to extinction due to WNS.

Action No./ Task No.	Activity	Lead	Required Expertise	Review	Relative Order	Est. Timeframe	Estimated Budget & Status	In Progress
Action Item 1.1: Seek consensus on feasible monitoring techniques and protocols that will gauge population impacts of WNS on bat species.								
1.1.1	Plan and implement a bat population monitoring and population modeling workshop for the purpose of designing statistically robust and logistically feasible methods for monitoring changes in bat populations in response to WNS, treatment measures, and conservation and recovery efforts. Explore the use of alternative methods (e.g., citizen science programs) to achieve some population monitoring goals.	Population Monitoring Subgroup	Ed Arnett (TRCP), Susan Loeb (USFS), Paul Cryan (USGS), Laura Ellison (USGS)	N/A	1	2012	Completed	Financially supported by USFWS, BLM, USGS, USFS, and BCI

1.1.2	Summarize and report workshop conclusions and recommendations at the 2012 WNS Symposium and a North American Society of Bat Research Meeting to provide interim guidance and obtain feedback.	Population Monitoring Subgroup	Susan Loeb (USFS), Paul Cryan (USGS), Laura Ellison (USGS)	N/A	2	2012	Staff Time (320 hrs.) + $4,000	Partially funded 2012 WNS Symposium Completed

1.1.3	Produce a white paper to describe bat population monitoring and modeling options and preferred methodologies (for *Activity No. 1.2.2*) at various spatial scales, based on workshop results.	Population Monitoring Subgroup	Susan Loeb (USFS), Paul Cryan (USGS), Laura Ellison (USGS)	N/A	3	2013	Staff Time (480 hrs.) +$2,000	Funded In-kind agency and organization time
Action Item 1.2: Develop and implement monitoring plans to establish the degree to which different species of bats are vulnerable to WNS.								
1.2.1	Prioritize species, geographies, and seasons for monitoring efforts (*see Activity No. 2.1.3*). – Addressed during 2012 Population Monitoring Workshop; findings to be discussed with broader audience at 2012 WNS Symposium and subsequent meetings.	Population Monitoring Subgroup		Annually	1	2012	Staff Time (200 hrs.)	Partially Funded

1.2.2	Formulate an interagency population monitoring program for WNS-susceptible species with measureable objectives for assessing population size, trends, and variation in trends. Use recommendations from *Activity No. 1.1.1* to determine demographic parameters to measure, frequency of measurement and appropriate sample sizes. Identify and account for non-WNS sources of mortality, as possible, in the monitoring program. Incorporate citizen science programs into short-term and long-term monitoring plans, as applicable, according to recommendations from *Activity No. 1.1.1 and 1.1.2.*	Population Monitoring Subgroup	Population Modelers	N/A	2	2013	Staff Time (1,600 hrs) + $15,000	Not funded
1.2.3	Implement an interagency population monitoring program for WNS-susceptible species using the recommended monitoring protocols (*see Activity No. 1.1.3*), including applicable citizen-science programs, based on species priority (see *Activity No. 1.2.1*).	Population Monitoring Subgroup and Data Management Working Group	State, federal and tribal natural resource agencies	Every 3 years	3	2013, 2014, 2015	$500,000/yr to $2,500,000/ yr	Not funded
1.2.4	Establish and fill an Interagency WNS Monitoring Coordinator position. Responsibilities would include (1) coordination of the development and maintenance of a database of population monitoring data collected by state, federal and tribal natural resource agencies, and (2) analysis of population monitoring data, and (3) reporting status of bat populations annually.	Conservation and Recovery Working Group	Database development	Annually	2	2013-2015	$100,000 per year	Not funded

Action Item: 1.3 Establish best management practices for population monitoring on a range-wide scale for species of conservation concern*. **Species of conservation concern are those WNS-affected bat species most vulnerable to extinction*								
1.3.1	Provide guidance to federal, state and tribal natural resource agencies on how to conduct monitoring activities related to *Activity No's. 1.1.3 and 1.2.2*.	Population Monitoring Subgroup and WNS Monitoring Coordinator	Communications and Outreach Working Group	Annually	3	2013	Staff Time (320 hrs)	Not funded

Goal 2: Establish criteria for prioritizing conservation activities.

Action No./ Task No.	Activity	Lead	Required Expertise	Review	Relative Order	Est. Timeframe	Estimated Budget & Status	In Progress
Action Item 2.1: Develop criteria for determining which species affected by WNS warrant conservation action, that may include identifying proportions of populations affected or thresholds of population size at which conservation actions should be taken.								
2.1.1	Develop a WNS-risk ranking system for all cave-dwelling bat species (or populations) in North America to inform conservation and recovery activities identified in this Activity Schedule (e.g., based on species vulnerability, susceptibility, geographic range, and population size). Evaluate ranking outcomes using disease surveillance data.	Species Recovery Subgroup	Epidemiology Working Group and Disease Surveillance Working Group	Annually	1	2012 2013, 2014, 2015	Staff Time (800 hrs) Staff Time (160 hrs/yr)	Not funded

2.1.2	Develop Population Viability Assessment (PVA) models for WNS-susceptible species (~10 species). -LBB (Frick, USFWS) -IB (Amelon)	Species Conservation Subgroup	Population Genetics Expertise	N/A	2	2012(1), 2013(3), 2014(3), 2015(3)	$100,000 per species	Partially funded
2.1.3	Determine distributions of WNS-susceptible species across the North American landscape, including seasonal distributions and migration corridors, based on results of the Interagency Population Monitoring Program and other monitoring and modeling efforts.	Species Recovery Subgroup	WNS Monitoring Coordinator	Annually	1	2013, 2014, 2015	$5,000 (map data); $1,000/yr to update map	Not funded
2.1.4	Review recovery plans for federally listed species affected by WNS and incorporate any additional recovery objectives and/or recovery actions necessary to address WNS threats and limiting factors. Estimated Status Review schedules: Indiana and Gray Bat (initiate 2011), Virginia Big-eared Bat (initiate 2012), Ozark Big-eared Bat (initiate 2013+)	Species Recovery Subgroup	USFWS and Recovery Teams	During USFWS 5-year Review Process	1	2011-2015	$100,000	Partially funded (USFWS)
Action Item 2.2: Develop contingency plans for adapting conservation actions if populations of conservation concern decline and approach the threshold of population viability (e.g., extirpation or extinction).								
2.2.1	Establish criteria for implementing captive management measures for WNS-affected species using the structured decision making process.	Species Recovery Subgroup	*See Activity No. 3.3.5*					Completed

Goal 3: Determine the best practices for maintaining and recovering populations.

Action No./ Task No.	Activity	Lead	Required Expertise	Review	Relative Order	Est. Timeframe	Estimated Budget & Status	In Progress
Action Item 3.1: Develop techniques and protocols for assessing and mitigating the population effects of WNS.								
3.1.1	Develop protocols and techniques for assessing population effects of WNS.	Population Monitoring Subgroup	*See Activity No. 1.2.3*					Not funded
3.1.2	Identify, through research and adaptive management, strategies available to minimize/mitigate population effects of WNS; promote and implement viable strategies. Research needs updated annually (see *Activity No. 4.1.1*).	Conservation and Recovery Working Group	Scientists from universities and Federal, State, and Tribal Agencies	Annually	2	2011-2015	TBD	Not funded
3.1.3	Develop and provide best management practices for species and habitat protection and conservation to state, federal and tribal natural resource agencies to assist with conservation planning for WNS-affected species not already covered under federal recovery plans.	Species Conservation Subgroup	Emily Preston (leader), Habitat management experts	N/A	2	2013	$242,000	Partially Funded In-kind agency time
3.1.4	Provide guidance in the development, implementation, and maintenance of state-level WNS response plans.	Species Conservation Subgroup	USFWS; State Wildlife Agencies	Annually	1	2011-2015	$120,000/yr	Partially Funded In-kind agency time
3.1.5	Provide guidance on incorporating protection and conservation activities for WNS-affected species into State Wildlife Action Plans or other land management or conservation plans.	Species Conservation Subgroup	USFWS; state, federal and tribal Agencies	As needed	2	2012-2015	$120,000/year	Not funded

Action Item 3.2: Prioritize monitoring and recovery efforts based on analysis of species vulnerability (see National WNS Plan, Section E2, Goal 3).								
3.2.2	Develop protocols for monitoring populations on the landscape that may not be easily monitored in hibernacula.	Population Monitoring Subgroup	*See Activity No's. 1.1.1 and 1.2.3*					Partially funded
Action Item 3.3: Determine the feasibility and role for captive management for species of conservation concern. These actions could include translocation, temporary captivity, propagation, and cryopreservation.								
3.3.1	Conduct a captive management pilot project using the Virginia big-eared bat.	Species Recovery Subgroup	Captive rearing expertise	N/A	1	2010	Completed	N/A
3.3.2	Compile the existing captive management knowledge-base through interaction with experts	Species Recovery Subgroup	Zoological societies, wildlife rehabilitators	N/A	1	2010	Completed	N/A
3.3.3	Conduct a workshop to identify and evaluate the feasibility of captive management strategies.	Species Recovery Subgroup	Zoological societies, wildlife rehabilitators	N/A	1	2010	Completed	N/A
3.3.4	Establish a Captive Management Team within the Species Recovery Subgroup.	Species Recovery Subgroup	N/A	N/A	2	2011	Completed	N/A
3.3.5	Identify preferred alternatives for implementing captive management measures for WNS-affected species using the Structured Decision Making process.	Species Recovery Subgroup	Captive Management Team	N/A	2	2012	Completed	N/A
3.3.6	Establish criteria for implementing captive management preferred alternatives for WNS-affected species (see *Activity No. 3.3.5*).	Species Recovery Subgroup	Captive Management Team	N/A	3	2012-2013	TBD	Not funded

3.3.7	Implement captive management projects, when deemed important.	Species Recovery Subgroup	Captive Management Team	N/A	3	TBD	TBD	Not funded
3.3.8	Investigate use of artificial hibernacula to facilitate WNS-related research.	Species Recovery Subgroup	*See Activity No. 3.6.4*					Not funded
Action Item 3.4: Protect or restore summer and winter habitat to ensure that quality habitat is available for bat populations before and after exposure to WNS.								
3.4.1	Promote research to address information gaps related to summer and winter habitat needs of WNS-affected species. Research needs updated annually (see *Activity No. 4.1.1*).	Species Conservation and Species Recovery Subgroups	Scientists from universities and Federal, State, and Tribal Agencies	N/A	2	Ongoing	TBD	Not funded
3.4.2	Assess winter and summer habitat availability (i.e., distribution, integrity and trends) for WNS-affected species, and provide guidance to Federal, State, and Tribal natural resource agencies on habitat management strategies for public and private lands.	Species Conservation and Species Recovery Subgroups	State, federal and tribal natural resource agencies	Annually	2	2013, 2014, 2015	$125,000 per year	Not funded
3.4.3	Provide guidance on prioritizing occupied summer and winter habitat of WNS-affected species for protection and restoration at range-wide and state levels (e.g., travel corridors, historic maternity grounds, hibernacula).	Species Conservation and Species Recovery Subgroups	State, federal and tribal natural resource agencies		2	2012	Staff Time (480 hrs)	Not funded

3.4.4	Provide summer and winter habitat protection and restoration guidance to Federal, State and Tribal natural resource agencies, through best management practices, for public and private lands. Such guidance may include, but is not limited to protection and restoration measures for non-structural habitat (e.g., forest management), and alternative summer roosting structure design and placement (e.g., roosting boxes, bridge enhancement). Tie in with *Activity No. 3.7.1*.	Species Conservation and Species Recovery Subgroups	State, federal and tribal natural resource agencies; conservation education organizations	N/A	2	2013	Staff Time (480 hrs) +$25,000	Not funded
3.4.5	Identify opportunities to provide summer and winter habitat protection and enhancement incentives for private landowners (e.g., BMPs for forest management and cave/karst management).	Species Conservation and Species Recovery Subgroups	State, federal and tribal natural resource agencies	N/A	2	2012	Staff Time (320 hrs)	Not funded
Action Item 3.5: Should proven environmental treatments for WNS become available, establish methods for restoring hibernation sites to provide refuge for surviving and non-affected individuals.								
3.5.1	Coordinate with the Disease Management Working Group to identify trial hibernacula restoration measures and criteria to be used for selecting sites.	Species Recovery Subgroup	Cave biologists and ecologists		2	2014, 2015	Staff Time (320 hrs)	Not funded
3.5.2	Prioritize WNS-affected hibernacula for restoration trials.	Species Recovery Subgroup	State, federal and tribal natural resource agencies		2	2014	Staff Time (320 hrs) + $42,500	Not funded

Action Item 3.6: Identify previously occupied hibernacula and suitable but previously unused sites that warrant continued protection for bat recovery, and clearly identify a means of justifying such protection.								
3.6.1	Develop and maintain a database of information of (1) previously occupied hibernacula that warrant continued protection for species recovery, and (2) suitable but previously unoccupied hibernacula that warrant continued protection for species recovery, and (3) occupied sites pre- and post-WNS.	Species Conservation Subgroup	Data Management Working Group; Database developer; state, federal and tribal natural resource agencies		3	2014, 2015	$25,000 (develop database) + $75,000/yr (data input)	Not funded
3.6.2	Assess bat occupancy in hibernacula (caves and abandoned mines with no safety concerns) and populate the database (*see Activity No. 3.6.1*).	Species Conservation Subgroup	state, federal and tribal natural resource agencies		1	2011-2015	$10,000 to $50,000 per yr per agency/state	Not funded
3.6.3	Determine and prioritize caves and abandoned mines occupied by federally listed species that need gating (see "Agency Guide to Cave and Mine Gates, 2009").	Species Conservation Subgroup	State, federal and tribal natural resource agencies		3	Ongoing	$125,000 per yr	Not funded
3.6.4	Implement feasibility trials for assessing use of artificial hibernacula by WNS-affected bat species (e.g., box culverts and bunkers, hand dug wells and cisterns, missile silos). See related *Activity No. 3.3.7*. – The Nature Conservancy's Artificial Hibernaculum Project – New Hampshire Fish and Game Bunker Project	Species Recovery Subgroup	Susi von Oettingen and Emily Preston (leads), natural resource agencies, TNC, and Disease Mgt WG	N/A	1	2012-2015	$100,000/yr	Partially Funded In-kind Agency and Organization Time and Funds

Action Item 3.7: Mitigate the anthropogenic sources of mortality that have additional detrimental influences on bat populations.								
3.7.1	Compile a set of Best Management Practices for public and private land managers that will include suggested species and habitat protection and restoration measures (*see Activity No. 3.4.4*).	Species Conservation and Species Recovery Subgroups	Emily Preston (leader), habitat management experts	Annually	1	2013	Staff Time (320 hrs)	Partially Funded In-kind Agency Time and Funds
3.7.2	Develop bat conservation information material for use in citizen educational program delivery.	Species Conservation and Species Recovery Subgroups	Conservation education organizations and agencies	Annually	2	2013, 2014	Staff Time (480 hrs/yr) + $25,000	Not funded
3.7.3	Provide Best Management Practices for animal control agencies and companies, through state wildlife agencies, to reduce effects to WNS-affected species and populations during bat control or removal activities in houses and buildings.	Species Conservation and Species Recovery Subgroups	Justin Stevenson (leader), natural resource agencies	Annually	1	2012	Staff Time (320 hrs/yr) + $10,000	Partially Funded In-kind Agency and Organization Time and Funds
3.7.4	Collaborate with the caving community, commercial cave managers, and cave researchers to minimize impacts to hibernating bats.	Species Conservation and Species Recovery Subgroups	National Speleological Society	N/A	1	2011-2015	Staff Time (240 hrs/yr) + $4,500/yr	Not funded
3.7.5	Explore opportunities to utilize mitigation or conservation banks to increase opportunities to reduce anthropogenic-related threats and limiting factors to WNS-affected species (e.g., disturbance during hibernation).	Species Conservation and Species Recovery Subgroups		N/A	3	2013, 2014, 2015	Staff Time (40 hrs/yr)	Not funded

Goal 4: Research most effective methods for monitoring, conserving, and recovering affected populations.

Action No./ Task No.	Activity	Lead	Required Expertise	Review	Relative Order	Est. Timeframe	Estimated Budget & Status	In Progress
Action Item 4.1: **Establish and maintain a list of prioritized research needs and work closely with other working groups to see that high priority needs are communicated and/or addressed.**								
4.1.1	Develop and maintain a list of high priority research needs for improved population monitoring, species recovery and conservation methodologies.	Conservation and Recovery Working Group	Conservation and Recovery Working Group leader	Annually	1	2011-2015	Staff Time (8 hrs/yr)	Funded In-kind Agency Time
4.1.2	Compile research needs from all working groups to identify common research interests and priorities, and seek out and announce WNS research funding opportunities.	National WNS Coordinator	Working group leaders	Annually	1	2011-2015	Staff Time (80 hrs/yr)	Funded In-kind Agency Time
Action Item 4.2: **Regularly assess monitoring, conservation, and recovery practices in light of new research findings, and refine when appropriate.**								
4.2.1	Convene a follow-up population monitoring workshop to evaluate status of monitoring programs and their results and develop or refine protocols, as needed (in relation to *Action No. 1.1.1*).	Population Monitoring Subgroup	PM	N/A	3	2015	Staff Time (320 hrs) + $92,500	Not funded
4.2.2	Participate in WNS-related meetings and conferences to report accomplishments and findings to obtain new conservation and recovery information needs, and to interact with other working groups.	Conservation and Recovery Working Group	State, federal and tribal natural resource agencies	N/A	1	2011-2015	$122,500/yr	Funded In-kind Agency Time and Funds
4.2.3	Review Best Management Practices periodically and incorporate new	Conservation and Recovery	Species Conservation Subgroup	Annually	3	2013+	Staff Time (320 hrs/yr)	Not funded

	scientific findings, as needed (*see Activity No's. 3.1.3 and 3.7.1*).	Working Group						

APPENDIX 4. BUDGET SUMMARY BY GOAL

WNS National Plan Goal		Year					
		2011	**2012**	**2013**	**2014**	**2015**	**Total**
Develop and validate rapid assessment monitoring plans to determine differences in susceptibility among species, and identify which species are most vulnerable to extinction due to WNS.	Staff Time (Hours)	0	680	2,400	0	0	3,080
	Budget (Dollars)	0	$4,000	$617,000-$2,617,000	$600,000-$2,600,000	$600,000-$2,600,000	$1,821,000-$7,821,000
Establish criteria for prioritizing conservation activities.	Staff Time (Hours)	0	800	160	160	160	1,280
	Budget (Dollars)	0	$150,000	$355,000	$301,000	$301,000	$1,107,000
Determine the best practices for maintaining and recovering populations.	Staff Time (Hours)	240	1,360	1,560	1,080	280	4,520
	Budget (Dollars)	$859,500-$2,659,500	$979,500-$2,769,500	$1,386,500-$3,176,500	$1,262,000-$3,052,000	$1,169,500-$2,959,500	$5,667,000-$14,617,000
Research most effective methods for monitoring, conserving, and recovering affected populations.	Staff Time (Hours)	88	88	408	408	728	1,720
	Budget (Dollars)	$122,500	$122,500	$122,500	$122,500	$215,000	$705,000
Total	Staff Time (Hours)	328	2,928	4,528	1,648	1,168	10,600
	Budget (Dollars)	$992,000-$2,659,500	$1,286,000-$2,803500	$2,481,000-$5,793,500	$2,285,500-$5,652,500	$2,285,500-$5,559,500	$9,300,000-$22,438,000