

White-Nose Syndrome (WNS) Research and State Funding through FY2015

Between 2008 and 2015, the USFWS has provided approximately \$20 million to researchers, state agencies, and others for WNS research and support:

Research and State Capacity Grants (by Fiscal Year)

2015 – As of February 2015 approximately \$155K of internally-directed Recovery funding allocated.

Additional expenditures for 2015 include:

- ~\$2,500,000 anticipated for research through three requests for proposals (federal capacity, open and small grants)
- ~\$1,000,000 anticipated to state agencies for research & response support

2014 – Approximately \$4.8 million in Recovery (internally directed) and Office of Science Application funds

- \$1,576,602 through federal request for proposals, 8 projects
- \$1,892,785 through an open request for proposals, 9 projects
- \$1,276,088 to 30 state agencies for research and response support
- \$50,000 to support bat migration study selected by Office of Science Applications

2013 – Approximately \$1.4 million in Recovery (internally directed) and other funds

- ~\$400,000 for research and monitoring, 5 projects
- \$950,694 to 28 state agencies for research and response support

2012 - Approximately \$2.6 million in Recovery (internally directed) and other funds

- ~\$1.6 million for WNS research through competitive request for proposals processes and direct contracting, 8 projects
- \$966,431 to 30 state agencies for research and response support

2011 – Approximately \$460K in Recovery funding (internally directed)

- \$460,388 for WNS research and diagnostics

2010 – Approximately \$2.8 million in Recovery funds (including both Congressional appropriations and internally directed)

- \$1.7 million for WNS research through a competitive request for proposals process and direct contracting, 7 projects
- Just over \$1 million to 23 state agencies for research and response support through two grant opportunities

2009 – \$1.3 million in Recovery funds and \$304K through the National Wildlife Refuge System

- \$925,000 for WNS research through a competitive request for proposals process
- \$400,000 awarded to 23 state agencies
- \$303,500 for contaminants research through off-Refuge grant

2008 – \$500,000 in Recovery funds

In addition, the U.S. Fish and Wildlife Service has proposed more than \$900,000 in WNS research through the U.S. Geological Survey's Science Support Partnership and Quick Response Programs.

Competitive State Wildlife Grants from the U.S. Fish and Wildlife Service

2014 – \$1,265,319

- Grant 1: states (AZ – lead, CA, CO, ID, MO, TX, UT, WA) - \$449,419
- Grant 1: others (Bat Conservation International) – \$50,420
- Grant 2: states (NC – lead, SC) - \$265,480
- Grant 3: states (NE, WY) - \$500,000

2013 – No award. Total request: \$361,000 – proposal not considered

States applying: WI, CT, FL, MN, NH, TN, VT, WV

2012 – No application

2011 - \$445,715

- States (AZ - lead, CA, ID, MT, NV, WA, TX)- \$292,616
- Others (Bat Conservation International) - \$153,099

2010 – \$998,834

- States (AR - lead, AL, DE, FL, MI, NC, TN, WI, WV) - \$749,216
- Others (Bat Conservation International) - \$249,618

2009 – \$940,870

- States (PA - lead, CT, DE, MD, NH, NJ, NY, VA, VT, WI, WV)- \$812,673
- Others (Bat Conservation International, other) - \$128,197

Details of WNS Research Grants Awarded by U.S. Fish and Wildlife Service 2010-2015

2015

- **Assessment of Residual Northern Long-eared Bat Reports and WNS Leading-edge Metrics, \$155,052**
W. Mark Ford, U.S. Geological Survey – Virginia Cooperative Fish and Wildlife Research Unit
- Three requests for proposals in 2015 pending

2014

- **A Regional Scale Assessment of Migration and Swarming Movements of Indiana Bats (*Myotis sodalis*) and Northern Myotis in the Indiana Bat Midwest Recovery Unit, \$50,000 (partial contribution to larger Service-funded project)**
Justin Boyles, Southern Illinois University; Liam McGuire, Texas Tech University

Federal grant projects:

- **Implementation and Summer Pilot of the North American Bat Monitoring Program (NABat), \$371,417**
Laura Ellison, U.S. Geological Survey - Fort Collins (Colorado) Science Center; Susan Loeb, U. S. Forest Service; Kevin Castle, National Park Service, and Rita Dixon, Idaho Fish and Game
- **Expanded Surveillance for the Detection of *Pseudogymnoascus destructans* Distribution and Spread of WNS in the Continental United States, \$402,231**
Anne Ballmann, David Blehert, and Robin Russell, U.S. Geological Survey - National Wildlife Health Center (Madison, Wisconsin)
- **Management of Bat White-Nose Syndrome through Protective Skin Fungi and Activation of Host Immune Response, \$133,533**
David S. Blehert, U.S. Geological Survey – National Wildlife Health Center (Madison, Wisconsin) and Jeff Lorch, University of Wisconsin - Madison
- **Management of Bat White-Nose Syndrome by Suppression of Pathogenic Environmental Reservoirs, \$221,453**
David S. Blehert, U.S. Geological Survey – National Wildlife Health Center (Madison, Wisconsin) and Jeff Lorch, University of Wisconsin - Madison
- **Oral Vaccines and Delivery Methods for Controlling Disease in Bats, \$217,741**
Tonie E. Rocke, U.S. Geological Survey - National Wildlife Health Center (Madison, Wisconsin); David Blehert; Jorge Osorio and Bruce Klein
- **Survival and Recruitment in Affected Areas, Including Environmental or Behavioral Factors, \$37,727**
Susan Loeb, USDA Forest Service, Southern Research Station (Clemson, South Carolina); Roger Perry and Sybill Amelon
- **Using Genomics and Transcriptomics to Understand and Combat WNS: Determining and targeting virulence factors in *Pseudogymnoascus destructans*, \$170,650**
Daniel L. Lindner, US Forest Service, Center for Forest Mycology Research (CFMR) Northern Research Station (Madison, Wisconsin)
- **Development of Educational Tools to Inform and Engage the Public in Bat Conservation and White-Nose Syndrome Efforts (Project Edubat), \$21,850**
Cynthia Sandeno, U.S. Forest Service Eastern Region (West Virginia), Carol Zokaites and Gail Moede Rogall

Open grant projects:

- **Uncovering skin immune proteins as predictors of resistance against WNS, \$318,455**

Marianne Moore and Liliana Davalos State University of New York; Amy Russell, Grand Valley State University

- **Factors of the Innate Immune Response that Protect Virginia Big-eared Bats (*Corynorhinus townsendii virginianus*) from Infection by *Pseudogymnoascus destructans*, the Agent of White-Nose Syndrome, \$94,407**
Hazel Barton, University of Akron
- **Genomic differences between *Pseudogymnoascus destructans* and closely-related fungi from bat hibernacula: insights into fungal pathogenicity, physiology, and ecology, \$260,746**
Jeff Foster and Kevin Drees, University of New Hampshire; Daniel Lindner and John Palmer, U.S. Forest Service
- **Characterization of bat skin microbiomes during progression of white-nose syndrome to inform biologic interventions, \$60,938**
Tony Goldberg, University of Wisconsin; David Blehert, U.S. Geological Survey
- **The potential of mycoviruses for biocontrol of White-nose Syndrome of bats, \$223,009**
Jason Slot and Hannah Reynolds, The Ohio State University
- **Additional testing of the efficacy of chitosan to limit the growth of *Pseudogymnoascus destructans* on experimentally-infected bats, \$223,602**
Marten Vonhof and Robert Eversole, Western Michigan University; Timothy Carter, Ball State University; Kevin Keel, University of California, Davis
- **Physiological changes in remnant bat populations in WNS-affected areas, \$349,230**
DeeAnn Reeder and Ken Field, Bucknell University
- **Identification and Characterization of *Pseudogymnoascus destructans* Immunomodulatory Secondary Metabolites, \$302,398**
Nancy Keller, University of Wisconsin; Neil Kelleher, Northwestern University
- **Determining Over-Winter Survival of *Myotis septentrionalis* and *Myotis lucifugus* in Aeolus Cave, Vermont \$60,000**
Alan Hicks, Vesper Environmental LLC; Scott Darling, Vermont Fish and Wildlife Department; Carl Herzog, New York State Department of Environmental Conservation

2013

- **Determining the Importance of Environmental Reservoirs in Disease Development and Transmission of White-nose Syndrome, \$198,930**

Daniel L. Lindner, Ph.D. US Forest Service, Center for Forest Mycology Research

- **Band Retention, Band-related Mortality, and the Consequences of Winter Handling, on *Myotis lucifugus* near the WNS Zone, \$24,900**
Alan Hicks, Vesper Environmental LLC
- **Developing a comprehensive modeling strategy for estimating trends in North American bat species distributions and abundances, ~\$80,000¹**
Susan Loeb, Ph.D., US Forest Service; Jeremy Coleman, Ph.D., US Fish and Wildlife Service; Thomas Ingersoll, Ph.D., National Institute for Mathematical and Biological Synthesis; Laura Ellison, US Geological Survey; Thomas Rodhouse, Ph.D., National Park Service
- **Investigation into the torpor patterns of hibernating gray bats: Implications for WNS, \$47,145**
Eric Britzke, Ph.D., US Army Engineer Research and Development Center
- **Frequency and progression of *Geomyces destructans* infection and white-nose syndrome (WNS) on gray bats (*Myotis grisescens*) held in captivity, \$39,000**
Sybill Amelon, Ph.D., US Forest Service; Tom Tomasi, PhD., Missouri State University

2012

- **Assessing the risk of *Geomyces destructans* transmission by bats that occupy contaminated hibernacula in late summer, \$123,673**
Anne Ballmann, DVM, Ph.D., David Blehert, Ph.D., Carol Meteyer, DVM, and Robin Russell, Ph.D., USGS National Wildlife Health Center
- **Characterization of climatic parameters within bat hibernacula, their influence on environmental loads of *Geomyces destructans*, and implications for the mitigation of white-nose syndrome in bats, \$307,600**
David Blehert, Ph.D. and Michelle Verant, DVM, USGS National Wildlife Health Center; Jonathan Epstein, DVM and Kevin Olival, Ph.D., EcoHealth Alliance
- **Fungal Biocontrol Agents for Alleviation or Remediation of *Geomyces destructans*, \$76,630**
Vishnu Chaturvedi, Ph.D. and Sudha Chaturvedi, Ph.D., New York State Department of Health

¹ Partial funding for this project (\$50,000) was provided by the Landscape Conservation Cooperative network through a national grant opportunity offered by the U.S. Fish and Wildlife Service

- **Antifungal skin microbes as tools for WNS management, \$195,536**
Winifred F. Frick, Ph.D., A. Marmaduke Kilpatrick, Ph.D., University of California, Santa Cruz; Craig K.R. Willis, Ph.D., University of Winnipeg; and Jeffrey T. Foster, Ph.D., Northern Arizona University
- **Understanding WNS Survivors: Exploring Resilience and Resistance to Variable Levels of *Geomyces destructans* Exposure in Context of Mitigation and Conservation, \$289,772**
DeeAnn Reeder, Ph.D. and Ken Field, Ph.D., Bucknell University
- **Test of Biocompatible, Biodegradable, Widely Available and Inexpensive Anti-Fungal Agent on the Growth of *G. destructans*, the Causative Agent of White-Nose Syndrome, on Experimentally Infected Bats Under Controlled Laboratory Conditions, \$180,648** Maarten J. Vonhof, Ph.D., Western Michigan University; Timothy C. Carter, Ph.D., Ball State University; and M. Kevin Keel DVM, Ph.D.; Southeastern Cooperative Wildlife Disease Survey
- **Laboratory Studies of Host-Pathogen Interactions between *Geomyces destructans* and Bats, \$236,105**
Craig Willis, Ph.D., University of Winnipeg; Trent K. Bollinger, Ph.D. and Vikram Misra, Ph.D., University of Saskatchewan; Paul Cryan, Ph.D., USGS Fort Collins Science Center; Winifred F. Frick, Ph.D. and A. Marmaduke Kilpatrick, Ph.D., University of California, Santa Cruz; and Gudrun Wibbelt, DVM, Leibniz Institute for Zoo and Wildlife Research
- **Pre- and Post-White Nose Syndrome Survival of Bats Assessed using Passive Transponders on a Continental Scale, \$173, 919.**
Craig Willis, Ph.D., University of Winnipeg; Justin Boyles, Ph.D., University of Southern Illinois; Jeffrey T. Foster, Ph.D., Northern Arizona University; Winifred F. Frick, Ph.D. and A. Marmaduke Kilpatrick, Ph.D., University of California, Santa Cruz; and Lesley Hale, Ontario Ministry of Natural Resources

2011

- **Applied research designed to assist mitigation of White-Nose Syndrome in bats, \$115,000**
Kevin Keel, DVM, Ph.D.; University of Georgia Research Foundation, Inc. (Southeastern Cooperative Wildlife Disease Survey)
- **A systematic study of *Geomyces destructans* within WNS infected hibernacula in New York, \$94,188**
Vishnu Chaturvedi, Ph.D.; New York State Department Of Health
- **Development of an Automated System for Acoustic Identification of Bats, \$141,200**
Eric Britzke, PhD.; US Army Engineer Research and Development Center

- **Estimating the value of ecosystem services provided by bats, \$10,000**
Sybill Amelon, PhD.; USDA Forest Service
- **White-Nose Syndrome Disease Investigation Support, \$100,000**
Scott Wright, PhD.; USGS National Wildlife Health Center

2010

- **Development of DNA-based detection techniques capable of differentiating Gd from closely related non-pathogenic Geomyces species, \$228,355**
Daniel Lindner, US Forest Service; Andrea Gargas, Symbiology, LLC; Jeffrey T. Foster, Northern Arizona University; Jessie Glaeser, US Forest Service
- **Evaluating the pathogenicity of North American and European strains of Gd in cave bats, tree bats, and other mammalian hibernators, \$242,098**
Craig Willis, University of Winnipeg; David Blehert and Paul Cryan, US Geological Survey; Vikram Misra, University of Saskatchewan; and DeeAnn Reeder, Bucknell University.
- **Who will survive? Exploring individual, sex, and species differences in susceptibility and resistance to WNS, \$409,469**
DeeAnn Reeder, Bucknell University; Craig Willis and Jens Franck, University of Winnipeg.
- **Natural history of Geomyces in cave environments: phylogeny, ecosystem activities, natural and anthropogenic transport, \$244,016**
Hazel Barton, Northern Kentucky University
- **Fine-scale population structure in Gd: fungal genetics for understanding dispersal, transmission, and effects of WNS, \$142,222**
Jeffrey Foster, Northern Arizona University
- **A transcriptome approach to study the host-pathogen interactions in WNS, \$293,000**
Donna E. Akiyoshi, Tufts Cummings School of Veterinary Medicine; Hilary Morrison, The Marine Biological Laboratory; Alison Robbins, Tufts Cummings School of Veterinary Medicine.
- **Enhancement of WNS database and mapping functions, \$10,000**
Paul Cryan, USGS-Fort Collins Science Center

2009

- **Changes in body composition and immune responses in pre-hibernating and hibernating little brown myotis affected and unaffected by WNS, \$10,000**
Thomas Kunz and Jonathan Reichard, Boston University
- **Immune function, body composition and genetic correlates of bat WNS, \$105,000**
Thomas H. Kunz and Michael D. Sorensen, Boston University

- **The propagation and decontamination of WNS in the environment, \$155,355**
Hazel Barton, Northern Kentucky University; Kevin Keel, Southeastern Cooperative Wildlife Disease Study at Georgia State University
- **Assessing the Impact of White-nose Syndrome (WNS) on the Genetic Variability of Indiana Bats (*Myotis sodalis*), \$40,000**
Sybill Amelon, U.S. Forest Service – Northern Research Station; Guy Knudsen, University of Idaho; Sara Oyler-McCance, U.S. Geological Survey; Lori Eggert, University of Missouri
- **Expanding our understanding of white-nose syndrome in the Northeastern Vespertilionidae with emphasis on the little brown bats (*Myotis lucifugus*), \$63,938**
Deborah Iwanowicz and Tim King, U.S. Geological Survey – Leetown Science Center
- **Establishing a Security Population of the Virginia Big-eared Bat (*Corynorhinus townsendii virginianus*) at the Smithsonian’s National Zoological Park, \$322,652**
Nucharin Songsasen et al., Smithsonian Institution
- **Evaluation of the Potential Role of Environmental Contaminants in Significant Bat Mortality in the Northeastern United States (NY, MA, VT, CT, PA, IN), \$314,900 (funded by Environmental Contaminants Program, FY09 Off-Refuge Investigations Sub-activity). An additional \$24,000 contributed in WNS funds. (total = \$338,900)**
Anne L. Secord, Andrew Major, Steve Klassen, Dan Sparks, U.S. Fish and Wildlife Service
- **Population demographic models for the conservation of endangered Indiana bats at risk to white-nose syndrome, \$194,409**
Wayne Thogmartin, U.S. Geological Survey – Upper Midwest Science Center
- **White-Nose Syndrome Acoustic Monitoring Project at Grandpa’s Knob, Rutland County, Vermont, \$21,400**
Stantec Consulting Services Inc. - \$18,500
Eric Britzke - \$2,900
- **Demonstrating a Causal Link between a *Geomyces spp.* Fungus and White-Nose Syndrome in Little Brown Myotis (*Myotis lucifugus*), \$4,582**
David S. Blehert and Carol U. Meteyer, U.S. Geological Survey, National Wildlife Health Center

2008 U.S. Fish and Wildlife Service-funded grant projects

- **Geographic Distribution of the Psychrophilic Fungus (*Geomyces sp.*) Associated with White-Nose Syndrome, \$80,904**

David S. Blehert, U.S. Geological Survey, National Wildlife Health Center; Alan Hicks, NY Department of Environmental Conservation; Peter Youngbaer, National Speleological Society; Thomas H. Kunz, Boston University

- **Histopathological and Microbiological Evaluation of Chiropteran Wing Membranes for Fungal Induced Damage, \$20,790**
Elizabeth L. Buckles, Cornell University
- **Baseline data relevant to the White Nose Syndrome crisis: Analysis of survival, fecundity and colony population trends of *Myotis lucifugus* in the northeastern US for the past 15 years, \$20,400**
Winifred Frick, Central Coast Bat Research Group; Jacob Pollock, University of California – Santa Cruz; D. Scott Reynolds, St. Paul’s School; Thomas H. Kunz, Boston University
- **Assessing Immune Competence in Bats Naturally Affected by WNS and in Bats Artificially Infected by the Suspected White-nose Syndrome (WNS) Pathogen, \$68,687**
DeeAnn Reeder, Bucknell University; David S. Blehert, U.S. Geological Survey; Elizabeth L. Buckles, Cornell University; Alan Hicks, NY Department of Environmental Conservation; Ken A. Field, Bucknell University
- **Regional Surveillance of White Nose Syndrome, \$30,000**
Scott Darling, Vermont Fish and Wildlife Department
- **Hibernacula and Post-hibernacula Surveillance in Virginia for Identifying White-nose Syndrome, \$15,000**
Rick Reynolds, Virginia Department of Game and Inland Fisheries
- **Can Artificial Thermal Refugia Reduce Mortality Associated With White-Nose Syndrome?, \$28,081**
Craig Willis, University of Winnipeg; Justin G. Boyles, Indiana State University; Mary Timonin, Kristin Jonasson, and Tracie D. Parkinson, University of Winnipeg
- **Monitoring the effects of White-Nose Syndrome on summer colonies of Little Brown Bats, \$4,477**
Thomas Kunz and Jonathan Reichard, Boston University
- **Fluorescent in situ hybridization analysis of white-nose syndrome affected bats, \$30,000**
David S. Blehert, U.S. Geological Survey, National Wildlife Health Center
- **Development of a template for Region 3 States to use in WNS planning, \$22,609**
U.S. Fish and Wildlife Service Region 3
- **Hibernation arousal patterns in WNS and unaffected bats, \$13,265 (project largely funded through Northeast Regional Conservation Needs Grants program, but U.S. Fish and Wildlife Service contributed \$13,265 for travel and equipment purchase)**

Eric Britzke, Department of Defense; DeeAnn Reeder, Bucknell University; Craig Frank, Fordham University; and others