



Upper Midwest Environmental Sciences Center March-September 2021 Activity Report

Topics covered in the March-September 2021 activity and publications report.

Aquatic Invasive Species

- Integrated Pest Management
 - Extending a Terrestrial Paradigm to Aquatic Environments
 - A Brief Introduction to Integrated Pest Management for Aquatic Systems
 - Chemical Controls for an Integrated Pest Management Program
 - Climate Matching with an R Package
- Invasive Carp
 - Exploring how Vessel Activity Influences the Soundscape at a Navigation Lock on the Mississippi River
 - Dam Passage by Invasive Bigheaded Carps in the Upper Mississippi River
 - Meta-population Integral Projection Model (MetaIPM) Released
 - Demographic Rate Variability of Bighead and Silver Carps along an Invasion Gradient
- Sea Lamprey
 - Use of an Artificial Stream to Monitor Avoidance Behavior of Larval Sea Lamprey in Response to TFM and Niclosamide
- Zebra Mussels
 - Assessment of Binary Toxicant Mixtures on Zebra Mussel Mortality

Conservation Ecology and Planning

- Watershed-based Climate Change Vulnerability Assessment
- Interactive Climate Change Vulnerability Dashboard
- Land Use Change Influences Ecosystem Function in Headwater Streams of the Lowland Amazon Basin
- Great Smoky Mountains National Park and Foothills Parkway Mapping Project
- Riparian Forest Cover Modulates Phosphorus Storage and Nitrogen Cycling in Agricultural Stream Sediments
- Aquatic Ecosystem Metabolism as a Tool in Environmental Management
- Bridging the Research-implementation Gap in Avian Conservation with Translational Ecology
- Effects of Fatalities from Wind Energy on Raptor Populations using Potential Biological Removal and Demographic Models
- Common Loon Migration and Wintering Distribution
- Paths to Computational Fluency for Natural Resource Educators, Researchers, and Managers
- TrendPowerTool: A Tool for Estimating the Statistical Power of a Monitoring Program to Detect Population Trends

Upper Mississippi River Restoration

- Probabilities of Detecting Submersed Aquatic Vegetation Species using a Rake Method may vary with Biomass

Fish and Wildlife Health

- Impacts of White-Nose Syndrome (WNS) on Cave-Hibernating Bats in Eastern North America
- Using Tree Swallows to Assess Reductions in PCB Exposure as a Result of Dredging

Other

- Acronyms

Aquatic Invasive Species

Integrated Pest Management

North American Journal of Fisheries Management - Special Section: Integrated Pest Management

The NAJFM special issue on IPM includes articles by administrators, practitioners, and researchers who have studied and applied IPM in aquatic environments. After the introduction, papers describe a brief history of IPM and the Great Lakes Sea Lamprey example, a practitioners foundation as IPM evolves in aquatic environments, and an outline for chemical control methods and the regulatory processes. The last two papers, not included here, describe experimental approaches to fishes as biocontrol agents for dreissenid mussels and alternative methods and practices to control hull-fouling organisms and methods to prevent their spread.

➤ Introduction to a Special Section: Integrated Pest Management—Extending a Terrestrial Paradigm to Aquatic Environments

- Gaikowski, M., P. M. Kocovsky, 2021, Introduction to a Special Section: Integrated Pest Management—Extending a Terrestrial Paradigm to Aquatic Environments: North American Journal of Fisheries Management, 41:261-263, <https://doi.org/10.1002/nafm.10392>.

➤ A Brief Introduction to Integrated Pest Management for Aquatic Systems

- Hubert, T.D., Miller, J., and D. Burkett, 2021. A Brief Introduction to Integrated Pest Management for Aquatic Systems. North American Journal of Fisheries Management. 41: 264–275. <https://doi.org/10.1002/nafm.10331>

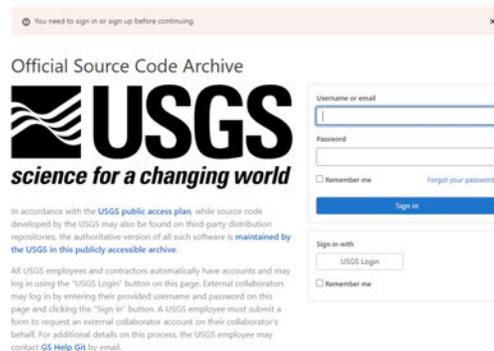
➤ Chemical Controls for an Integrated Pest Management Program

- Fredricks, K. T., T. D. Hubert, J. J. Amberg, A. R. Cupp, and V. K. Dawson, 2021, Chemical Controls for an Integrated Pest Management Program: North American Journal of Fisheries Management, 41:289-300, <https://doi.org/10.1002/nafm.10339>.

Climate Matching with an R Package

Richard Erickson and the USGS Species in Trade Horizon Scanning Team have released the climatchR package. The package takes the climatch algorithm developed by the Australian Government for invasive species screening (<https://climatch.cpl.agriculture.gov.au/>) and places the code into an R package that allows users of R to conduct screenings and evaluations. The climatchR method compares a species habitat based upon climate in its native habitat to possible habitats in future, invaded ranges. The new climatchR package allows both selective reviews and automated scripting and high-through species processing. For example, US agencies currently use the web-based climatch to manually model species one-at-a-time for invasive species risk assessments, such as the U.S. Fish and Wildlife Service's Ecological Risk Screening Summaries (https://www.fws.gov/fisheries/ans/species_erss.html). In contrast, USGS researchers are currently using climatchR to screen 1,000s of species in trade using scripting to help FWS prioritize possible new invasive species. This automation saves time and creates a scripted and documented workflow. The code can be found at <https://doi.org/10.5066/P9Q28JVU>. For additional information contact Richard Erickson at rerickson@usgs.gov (Ecosystems).

- Erickson, R. A., C. S. Jarnevich, H. R. Sofaer, P. Engelstad and D. W. Daniel, 2021, climatchR: An implementation of Climatch in R: U.S. Geological Survey software release, <https://doi.org/10.5066/P9Q28JVU>.

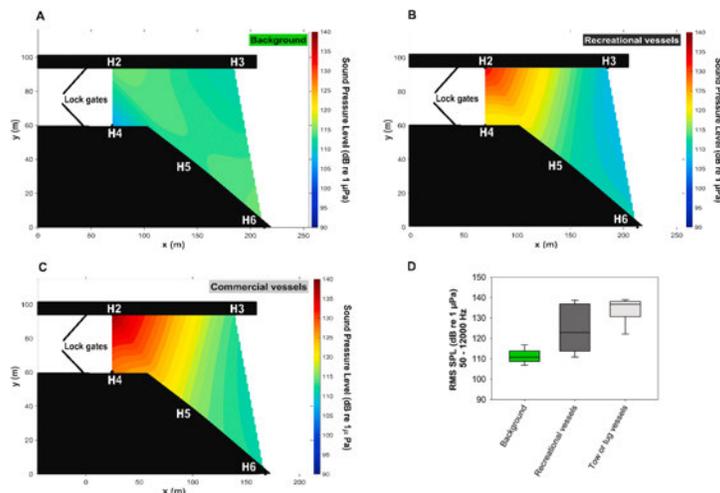


Publicly accessible archive for source code can be found at: https://code.usgs.gov/users/sign_in

Exploring How Vessel Activity Influences the Soundscape at a Navigation Lock on the Mississippi River

Marybeth Brey and colleagues from the University of Minnesota-Duluth authored a manuscript in the *Journal of Environmental Management* to assess the soundscape of a navigation lock approach. Acoustic recordings within the lock approach channel were collected and summarized for a two-month period to get a preliminary assessment of the soundscape of the lock approach over time in preparation for the deployment of an underwater Acoustic Deterrent System at Lock 19 on the upper Mississippi River. Recreational vessel traffic increased the overall average intensity of sound by 11dB and Commercial vessels increased the average intensity by 26dB. Access to the article is found online at <https://doi.org/10.1016/j.jenvman.2021.112720>. For more information contact Marybeth Brey at mbrey@usgs.gov (Ecosystems).

- Putland, R. L., M. K. Brey, and A. F. Mensinger, 2021, Exploring how vessel activity influences the soundscape at a navigation lock on the Mississippi River: *Journal of Environmental Management*, 296:112720, <https://doi.org/10.1016/j.jenvman.2021.112720>.

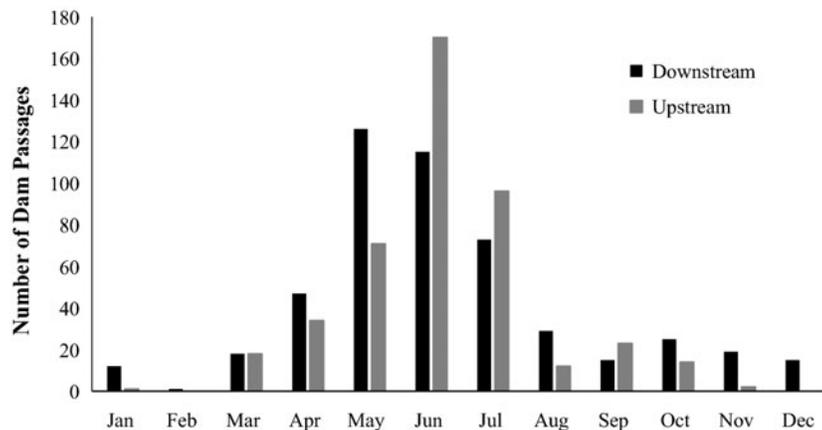


Sound-maps of median RMS SPL (dB re. 1µPa@ 50–12000 Hz) recorded at the five hydrophone locations inside the lock approach during A) background; B) recreational vessel passages; or C) commercial vessel passages on Saturday, 3 August 2019. D) RMS SPL for all recordings (dB re. 1µPa@ 50–12000 Hz) categorized as background, recreational vessels, and commercial vessels over the entire deployment period.

Dam Passage by Invasive Bigheaded Carps in the Upper Mississippi River

Jon Vallazza, Kyle Mosel, James Larson, Brent Knights (UMESC), and colleagues from the University of Wisconsin-La Crosse and U.S. Fish and Wildlife Service have published a paper that describes the movement patterns of invasive bigheaded carps past upper Mississippi River navigation dams. Results indicate most dam passages occurred during April through July and the probability of occurrence increased as dam hydraulic head decreased, and water temperatures exceeded 17° C. The study provides information useful for the development of deterrent technologies at mainstem dams and for targeted fish removal efforts. An early release version of the article is available online at <https://doi.org/10.1007/s10530-021-02583-8>. For more information contact Jon Vallazza at jvallazza@usgs.gov (Ecosystems).

- Vallazza, J. M., K. J. Mosel, D. M. Reineke, A. L. Runstrom, J. H. Larson, and B. C. Knights, On-line. Timing and hydrological conditions associated with bigheaded carp movement past navigation dams on the upper Mississippi river: *Biological Invasions*, <https://doi.org/10.1007/s10530-021-02583-8>.

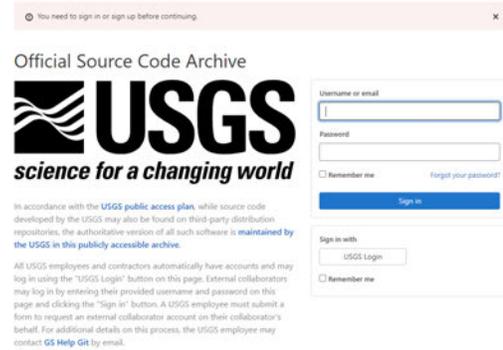


Monthly passages of upper Mississippi River Lock and Dams 15–19 by bigheaded carps during 2014–2017. Black bars are downstream passages and gray bars are upstream passages

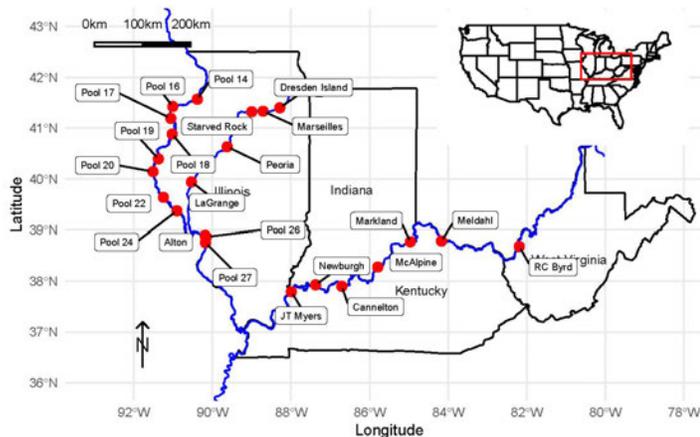
Meta-population Integral Projection Model (MetaIPM) Released

Scientists at the USGS Upper Midwest Environmental Sciences Center and the University of Wisconsin-La Crosse have released version 1.0 of MetaIPM: A Meta-population Integral Projection Model. The model captures both spatial and temporal dynamics. A network model is used to capture meta-population dynamics such as river pools. An integral projection model captures population dynamics within each node (e.g., the distribution of individual's size and population numbers through time). The model allows for the comparison of different management actions such as direct mortality (e.g., harvest), decreased connectivity between subpopulations, and modified individuals (e.g., the release of YY-males). The model was created with a fish-focus, but may be adapted to other species as well. Efforts are underway to apply the model to different situations including invasive carp modeling in the Mississippi River and its subbasins, native fish connectivity and management in the Mississippi River, and non-native aquatic species through the release of YY-males. The software may be download from <https://code.usgs.gov/umesc/quant-ecology/metaipm> as a Python package. For more information contact Richard Erickson at rerickson@usgs.gov (Ecosystems).

- Erickson, R.A., J.P. Peirce, and G. J. Sandland, 2021, MetaIPM: A Meta-population Integral Projection Model. Version 1.0: U.S. Geological Survey software release, <https://doi.org/10.5066/P9PW673G>.



Publicly accessible archive for source code can be found at: https://code.usgs.gov/users/sign_in



Depiction of the 23 pools in the Upper Mississippi River basin where Bigheaded Carp (*Hypophthalmichthys nobilis*, and *H. molitrix*), were collected using fishery-dependent and -independent sampling during 1997–2018. Blue lines are major rivers from which fish were collected. Red dots are approximate locations of pool starts (e.g., lock-and-dam structures for most pools). Names in boxes are pool names. Data were used to test whether demographic rates (length–weight relations including body condition, mortality, growth curves, and female maturity curves) varied among subpopulations across a gradient of invasion status.

Demographic Rate Variability of Bighead and Silver Carps along an Invasion Gradient

Scientists at the USGS Upper Midwest Environmental Sciences Center, Southern Illinois University, U.S. Fish and Wildlife Service, Kentucky DNR, Illinois Natural History Survey, Iowa State University, and Wisconsin DNR have had a paper accepted in the *Journal of Fish and Wildlife Management*. The authors examined spatial patterns of invasive bighead and silver carp in the Mississippi River Basin from >40,000 fish observations. They observed different fish population growth rates and fish body conditions across the invasion gradient. This finding is being used by the Illinois DNR and other management agencies to inform control strategies and highlights the importance of meta-population dynamics of invasive species. An early release version of the paper is available online, however at the time this highlight was written the DOI routing number had not been activated. The associated software and data release products are available at <https://doi.org/10.5066/P9Q6SURL> and <https://doi.org/10.5066/P9IAOZ8G>. For more information contact Richard Erickson at rerickson@usgs.gov (Ecosystems).

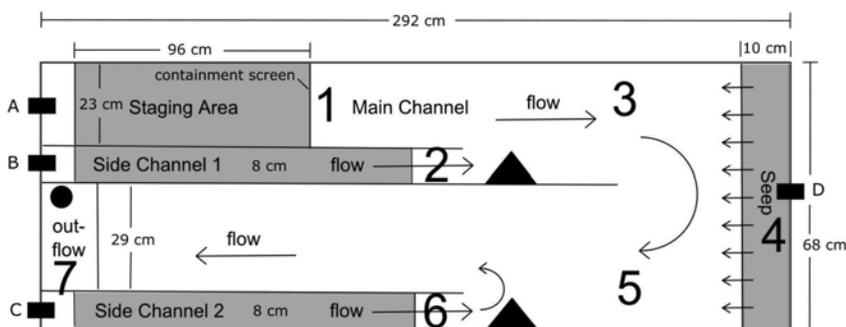
- Erickson RA, Kallis JL, Coulter AA, Coulter DP, MacNamara R, Lamer JT, Bouska WW, Irons KS, Solomon LE, Stump AJ, Weber MJ, Brey MK, Sullivan CJ, Sass GG, Garvey JE, Glover DC. 2021. Demographic rate variability of Bighead and Silver Carps along an invasion gradient. *Journal of Fish and Wildlife Management* 12(2); e1944-687X. <https://doi.org/10.3996/JFWM-20-070>

Sea Lamprey

Use of an Artificial Stream to Monitor Avoidance Behavior of Larval Sea Lamprey in response to TFM and Niclosamide

Nick Schloesser and colleagues published results from a laboratory study that used an artificial stream designed to evaluate if a niclosamide bar could be used as an alternative to the traditional 3-trifluoromethyl-4-nitrophenol (TFM) bar to control larval sea lamprey (*Petromyzon marinus*) in Great Lakes tributaries. Results indicated a niclosamide bar would effectively prevent sea lamprey escapement into freshwater during a lampricide treatment at concentrations unlikely to harm aquatic organisms. The development and use of an alternative niclosamide bar has the potential to use fewer bars to achieve similar results for management of sea lamprey in the U.S. and Canada. The article is available online at <https://doi.org/10.1016/j.jglr.2021.04.015>. For more information contact Nicholas Schloesser at nschloesser@usgs.gov (Ecosystems).

- Schloesser, N., Boogaard, M., Johnson, T., Kirkeeng, C., Schueller, J., and R. Erickson, 2021. Use of an artificial stream to monitor avoidance behavior of larval sea lamprey in response to TFM and niclosamide, *Journal of Great Lakes Research*, Volume 47, Issue 4, Pages 1192-1199, ISSN 0380-1330, DOI: 10.1016/j.jglr.2021.04.015.



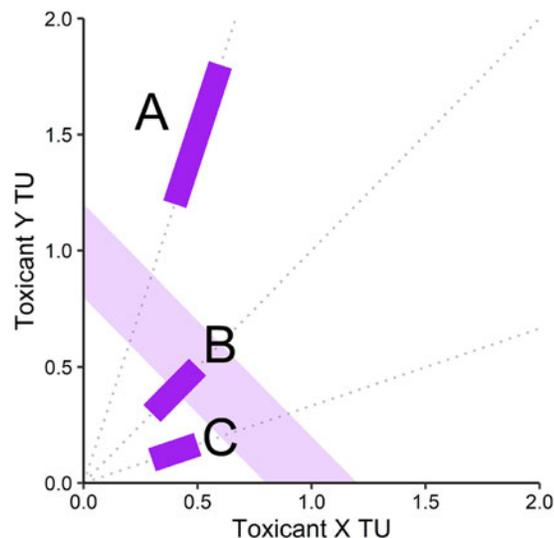
Overhead schematic of the fluvarium used to compare the avoidance behavior of larval sea lamprey to 3-trifluoromethyl-4-nitrophenol (TFM) and niclosamide. Inflows A, B, C, and D represent the locations where water, TFM treated water, or niclosamide treated water were added depending on the treatment. Gray areas represent the presence of sand for sea lamprey burrowing. Numbers (1-7) represent sample locations.

Zebra Mussels

Assessment of Binary Toxicant Mixtures on Zebra Mussel Mortality

Matthew Barbour, Justin Schueller, Todd Severson, Jeremy Wise, Matt Meulemans, James Luoma, and Diane Waller have published a paper investigating binary mixture efficacy of four zebra mussel toxicants. Mortality assessments indicated synergistic interaction in mixtures of niclosamide with EarthTec QZ (a copper-based product) or Clam-Trol CT-2 (a.k.a. Spectrus CT1300; a quaternary ammonia product). Mixtures including potassium chloride had antagonistic to additive effects on zebra mussel mortality. The findings identify potential for synergistic mixtures in zebra mussel control particularly in closed systems. The paper is available online at <https://doi.org/10.1016/j.aquatox.2021.105934>. For more information contact Matthew Barbour at mbarbour@usgs.gov (Ecosystems).

- Barbour, M. T., J. R. Schueller, T. J. Severson, J. K. Wise, M. J. Meulemans, J. A. Luoma, and D. L. Waller, 2021, Concentration addition and independent action assessments of the binary mixtures of four toxicants on zebra mussel (*Dreissena polymorpha*) mortality: *Aquatic Toxicology*, 238:105934, <https://doi.org/10.1016/j.aquatox.2021.105934>.

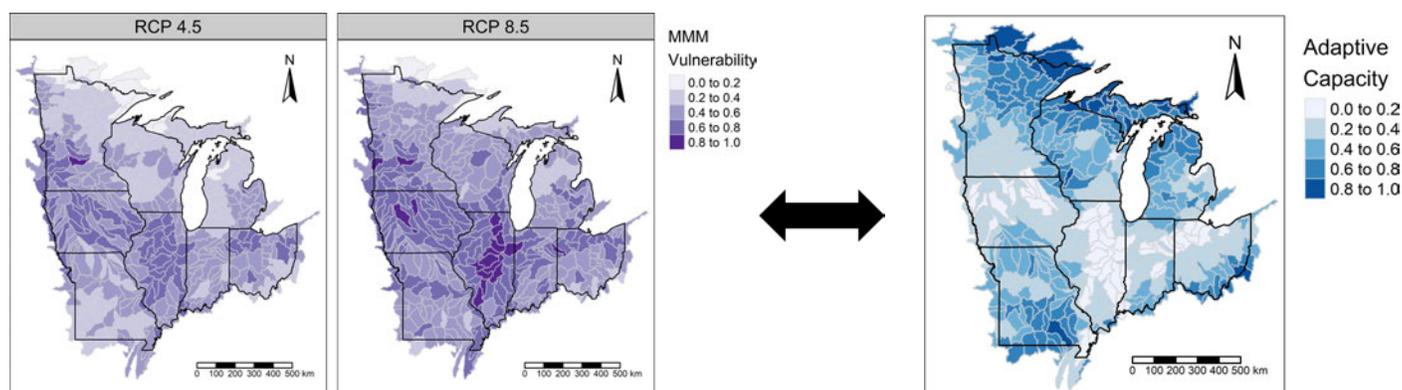


Graphical example of antagonism (A), additivity (B), and synergy (C) for a mixture of toxicants X and Y. The shaded region connecting the axes represents the 95% confidence interval for the predicted endpoint isobole and the solid polygons along the ratio lines represent the 95% confidence interval for the observed endpoints.

Watershed-based Climate Change Vulnerability Assessment

John Delaney and Kristen Bouska worked with USFWS managers to create a watershed-based climate change vulnerability assessment focused on aquatic-riparian ecosystems for the Midwest. Managers selected and weighted important climate change indicators that were combined into a composite vulnerability score for each watershed. Maps revealed regional differences in vulnerability to climate change. This spatial vulnerability assessment will help managers identify areas to prioritize for climate change adaptation. To learn about this project and more climate related projects go to <https://www.usgs.gov/center-news/development-a-climate-change-vulnerability-map-bodies-water-midwestern-us>. For more information contact John Delaney at jdelaney@usgs.gov (Ecosystems).

- Delaney, J.T., K.L. Bouska, J.D. Eash, P.J. Heglund, A.J. Allstadt, 2021, Mapping climate change vulnerability of aquatic-riparian ecosystems using decision-relevant indicators: Ecological Indicators, 125:107581, <https://doi.org/10.1016/j.ecolind.2021.107581>



Vulnerability composite. Values represent the multi-model mean (MMM) of the five climate models.

Adaptive capacity composite.

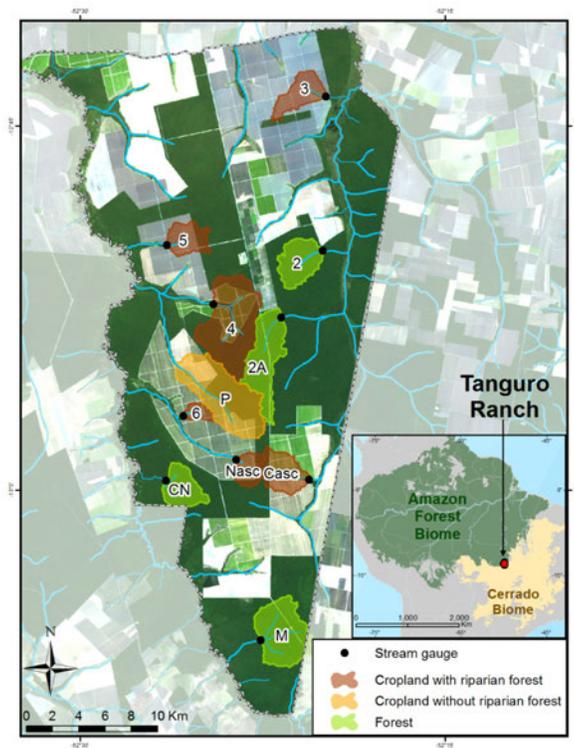
Interactive Climate Change Vulnerability Dashboard

John Delaney and Kristen Bouska have released an interactive watershed vulnerability online dashboard that they created in collaboration with the U.S. Fish and Wildlife Service. The tool allows users to create custom spatial vulnerability assessments for the Midwest by selecting and weighting the importance of 15 climate change indicators and five indicators of adaptive capacity. The Watershed-based Midwest Climate Change Vulnerability Assessment Tool is available at https://www.usgs.gov/apps/CC_Vulnerability. For more information contact John Delaney at jdelaney@usgs.gov (Ecosystems).

The screenshot shows the 'Watershed-based Midwest Climate Change Vulnerability Assessment Tool' dashboard. It features a map of the Midwest with a legend for 'Vulnerability' (0.0-1.0) and a sidebar with sliders for 'Exposure' (Hydrology) indicators: Mean Spring Flow, Number of High Flow Months, Sediment Load, Surface Runoff, and Total Nitrogen Load. The dashboard also includes a 'Potential Impact' tab and an 'Adaptive Capacity' tab. The USGS logo is visible at the top left.

https://www.usgs.gov/apps/CC_Vulnerability/

Land Use Change Influences Ecosystem Function in Headwater Streams of the Lowland Amazon Basin



Location of study area and streams. Study watersheds were delineated upstream from the stream gauge sampling location (shown in black). Watersheds are shown in colors according to their land use and riparian protection: green (forested), brown (cropland with riparian forest), and orange (cropland without riparian forest; Supplementary Materials, Methods Section). The inset shows the location of Tanguro Ranch (red square) in southeastern Amazonia, with dark green representing closed canopy forests, yellow representing deforested areas, and gray representing areas outside the Brazilian Amazon. Land cover layers are generated from Landsat 8 data (2013)

Kathi Jo Jankowski and colleagues published an article in a special issue of the journal *Water*, “Tradeoffs among Food Production, Forests, and Water Resources in Tropical Agricultural Frontiers,” titled, “Land use change influences ecosystem function in headwater streams of the lowland Amazon Basin.” The southeastern Amazon Basin has seen recent and widespread agricultural intensification; however, how this affects streams in the region and whether riparian buffers adequately protect streams is not well studied. To address these gaps, the authors evaluated the effects of intensive agriculture on stream organic matter, ecosystem metabolism, and nutrient dynamics in several headwater streams draining forested or cropland watersheds with intact riparian buffers. Overall, they found relatively subtle differences in stream function, indicating that riparian buffers have thus far provided protection against major functional shifts seen in other systems. However, the observed changes were linked to watershed scale shifts in hydrology, water temperature, and light availability resulting from watershed deforestation. In addition, nitrate uptake in all streams was low, indicating that if fertilizer nitrogen reaches streams, it will be exported in stream networks, which has implications for the conservation of tens of thousands of stream kilometers across the expanding Amazon cropland region. Access to the paper is found at <https://doi.org/10.3390/w13121667>. For additional information contact Kathi Jo Jankowski at kjankowski@usgs.gov (Ecosystems).

- Jankowski, K. J., L. A. Deegan, C. Neill, P. R. Ilha, H. Sullivan, L. Maracahipes-Santos, N. Marques, and M. N. Macedo, 2021, Land use influences stream ecosystem function in headwater streams of the lowland Amazon Basin: *Water*, 13(12):1667, DOI: 10.3390/w13121667

Great Smoky Mountains National Park and Foothills Parkway Mapping Project

USGS’s Upper Midwest Environmental Sciences Center conducted a close-out meeting for the National Park Service (NPS) Great Smoky Mountains National Park and Foothills Parkway (GRSM) vegetation mapping project, September 22, 2021. This meeting was conducted remotely via the Microsoft Teams meeting platform. The GRSM vegetation mapping project is part of the NPS Vegetation Mapping Inventory (VMI) Program, which produces data sets of vegetation occurring within national park units. Kevin Hop and Andrew Strassman provided overviews of the mapping project, vegetation classification scheme, vegetation mapping and accuracy assessment, and provided a demonstration of the final products. Close-out meetings provide a venue of questions and answers to occur between the recipients and developers; this ultimately enhances the understanding and use of products by the recipients. To learn more about the GRSM project go to <https://www.nps.gov/im/vmi-grsm.htm>. For additional information contact Andrew Strassman at astrassman@usgs.gov (Ecosystems).

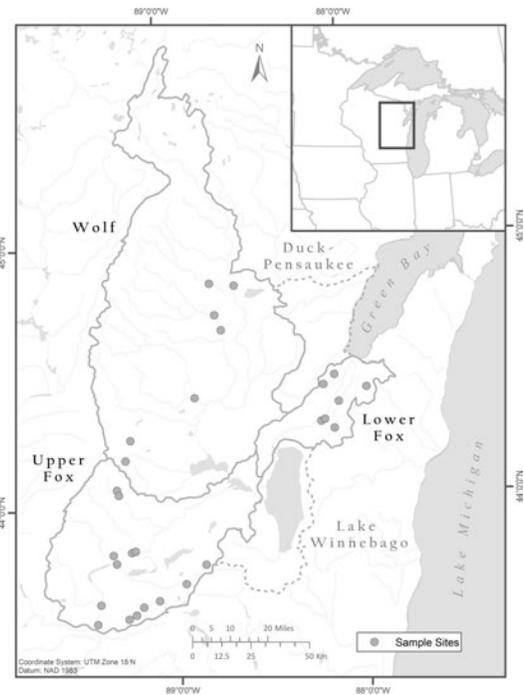


Heintooga Ridge Road. NPS Photo

Riparian Forest Cover Modulates Phosphorus Storage and Nitrogen Cycling in Agricultural Stream Sediments

Rebecca Kreiling, Lynn Bartsch, Patrik Perner, Enrika Hlavacek (all from UMESC), and Victoria Christensen (UMidWSC) are publishing “Riparian forest cover modulates phosphorus storage and nitrogen cycling in agricultural stream sediments.” In this paper, the authors assessed how riparian forest cover influences riverbed sediment nutrient processes at 28 sites three times throughout the growing season of 2018 in the Fox River watershed, Wisconsin. Riparian forest cover appeared to lessen the effect of agriculture in the watershed by decreasing the amount of fine sediment in the stream, resulting in less phosphorus storage. Nitrogen removal through microbially-mediated denitrification decreased with increased forest cover when the greatest connectivity between the watershed and in-stream processing occurred, likely due to decreased nitrate concentrations in areas with more forest cover. Access to the paper is found online at <https://doi.org/10.1007/s00267-021-01484-9>. For more information contact Rebecca Kreiling at rkreiling@usgs.gov (Ecosystems)

- Kreiling, R.M., L.A. Bartsch, P.M. Perner, E.J. Hlavacek and V.G. Christensen. 2021. Riparian forest cover modulates phosphorus storage and nitrogen cycling in agricultural stream sediments. *Environmental Management* 68:279-293. DOI: 10.1007/s00267-021-01484-9

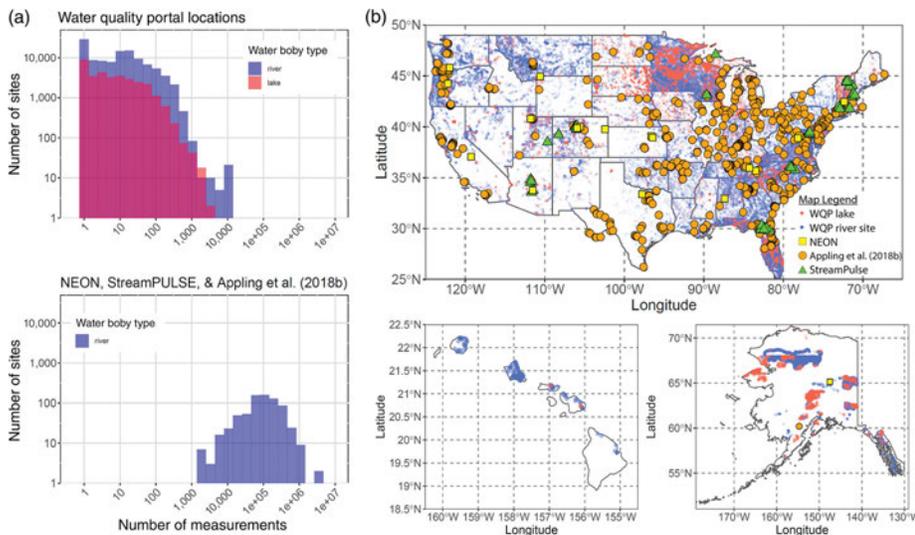


Study sites located in Fox River watershed, eastern Wisconsin, USA

Aquatic Ecosystem Metabolism as a Tool in Environmental Management

Kathi Jo Jankowski and colleagues have published an article reviewing the current approaches for using Dissolved Oxygen (DO) data in environmental management with a focus on the United States. They highlight new applications of diel DO data and metabolism - the measurement and interpretation of Gross Primary Productivity (GPP) and Ecosystem Respiration (ER) - in regulatory settings and explore how they can be applied to managing and monitoring ecosystems. They then review existing data types and provide a short guide for implementing field measurements and modeling of ecosystem metabolic processes using currently available tools. Finally, they discuss research needed to overcome current conceptual limitations of applying metabolism in management settings. This article is intended to facilitate the application of GPP, ER, and gas exchange to improve the assessment and management of environmental change in aquatic systems. An early release version of the paper is available online at <https://doi.org/10.1002/wat2.1521>. For more information contact Kathi Jo Jankowski at kjankowski@usgs.gov (Ecosystems).

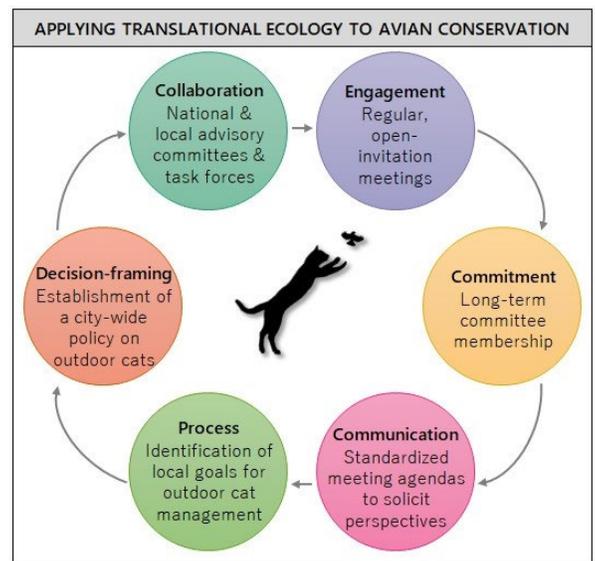
- Jankowski, K. J., F. H. Mejia, J. R. Blaszczak, and G. W. Holtgrieve, 2021, Aquatic ecosystem metabolism as a tool in environmental management: *WIREs Water*, e1521, DOI:10.1002/wat2.1521.



- (a) Histograms of the number of sites per the number of measurements for data from the Water Quality Portal (top panel) and the combined sites from the National Ecological Observatory Network (NEON; Water quality (DP1.20288.001). <https://data.neonscience.org>, the StreamPULSE database, and the dissolved oxygen time series used in the metabolism time series data published by Appling, Read, et al. (2018) (bottom panel).
- (b) Map of site locations in U.S. states from the histograms in panel a including Water Quality Portal (WQP) locations shown as small blue circles for rivers and small red circles for lakes, NEON river locations shown as yellow squares, StreamPULSE locations shown as green triangles, and rivers included in the Appling, Read, et al. (2018) publication shown as orange circles

Bridging the Research-implementation Gap in Avian Conservation with Translational Ecology

Wayne Thogmartin (UMESC), Eben Paxton (PIERC), Charles Van Riper (SBSC), and colleagues from a number of organizations including Audubon, U.S. Fish and Wildlife Service, U.S. Forest Service, and various universities published a review highlighting several case studies from the ornithological and conservation social sciences exemplifying six core translational ecology principles: collaboration, engagement, commitment, communication, process, and decision-framing. The authors demonstrate that following translational approaches can lead to improved conservation decision-making and delivery of outcomes via co-development of research and products that are accessible to broader audiences and applicable to specific management decisions (e.g., policy briefs and decision-support tools). They also identify key challenges faced during scientific producer–user engagement, potential tactics for overcoming these challenges, and lessons learned for overcoming the research-implementation gap. Finally, they recommend strategies for building a stronger translational ecology culture to further improve the integration of these principles into avian conservation decisions. An early release version of the paper is available online at, <https://doi.org/10.1093/ornithapp/duab018>. For more contact Wayne Thogmartin at wthogmartin@usgs.gov (Ecosystems).



Translational ecology is an intentional approach in which science producers and science users work collaboratively to define objectives and desired outcomes to co-produce research that, ideally, results in improved environmental decision-making.

- Saunders, S. P., J. X. Wu, E. Adams, B. Bateman, T. Bayard, S. Beilke, A. Dayer, A. M. V. Fournier, E. A. Gow, C. Hamilton, P. Heglund, K. Lankford, S. B. Lerman, N. L. Michel, E. Paxton, Ç. H. Şekercioğlu, M. A. Smith, W. E. Thogmartin, M. S. Woodrey, and C. van Riper III, 2021. Bridging the research-implementation gap in avian conservation with translational ecology, *Ornithological Applications*, Volume 123:3, 1-13, <https://doi.org/10.1093/ornithapp/duab018>.



Wind energy farm

Effects of Fatalities from Wind Energy on Raptor Populations using Potential Biological Removal and Demographic Models

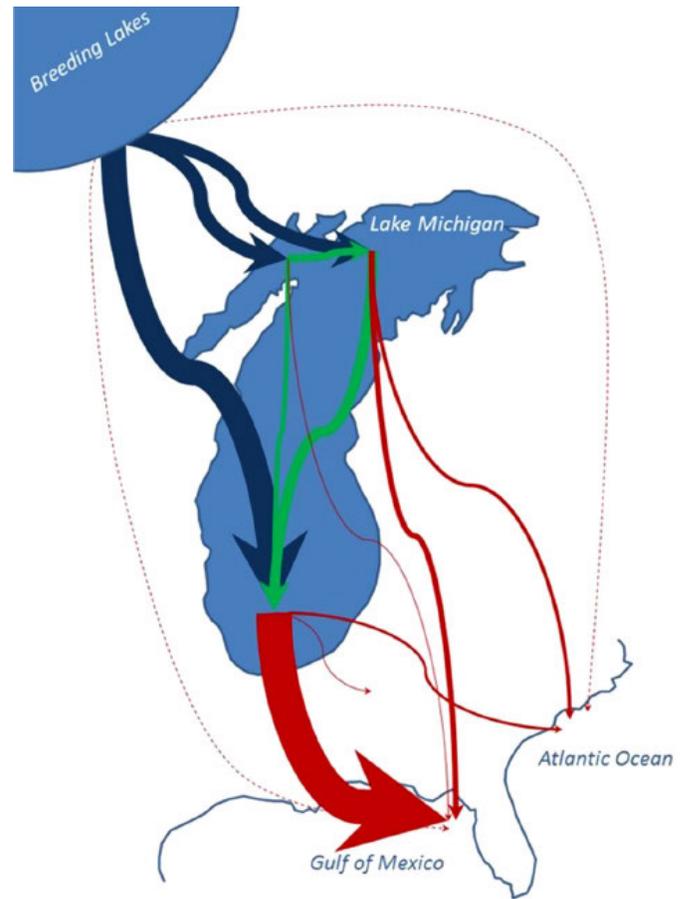
A paper titled, “Demographic and potential biological removal models identify raptor species sensitive to current and future wind energy;,” has been published in *Ecosphere*. Wind energy kills birds via collisions with spinning turbine blades. How these fatalities impact raptor populations now and into the future is not known. To address this question, USGS and co-authors studied how collisions with wind turbines may affect the populations of 14 raptor species. Their findings suggest those species with relatively higher potential of population-level impacts from wind turbine collisions included barn owl, ferruginous hawk, golden eagle, American kestrel, and red-tailed hawk. Access to the paper is available online at <https://esajournals.onlinelibrary.wiley.com/doi/full/10.1002/ecs2.3531>. For more information contact Jay Diffendorfer (jediffendorfer@usgs.gov) or Wayne Thogmartin (wthogmartin@usgs.gov).

- Diffendorfer, J.E., J.C. Stanton, J.A. Beston, W.E. Thogmartin, S.R. Loss, T.E. Katzner, D.H. Johnson, R.A. Erickson, M.D. Merrill, and M.D. Corum, 2021. Demographic and potential biological removal models identify raptor species sensitive to current and future wind energy. *Ecosphere*. 12(6):e03531. 10.1002/ecs2.3531

Common Loon Migration and Wintering Distribution

An article authored by Kevin Kenow, Luke Fara, Steve Houdek, Brian Gray, Tim Fox, Bob Kratt (UMESC) and several collaborators titled, "Migration patterns and wintering distribution of common loons breeding in the Upper Midwest," is now available online in the Journal of Avian Biology. The publication details the migration patterns and wintering distribution of breeding adult and juvenile common loons that were captured and marked on lakes in Minnesota, Wisconsin, and the Upper Peninsula of Michigan. The study provides information for use in developing geographical linkages among breeding, migratory, and wintering common loon populations. Implications for common loon conservation efforts are discussed. An early release, online Open Access, version of the article is available at <https://doi.org/10.1111/jav.02609>. For more information contact Kevin Kenow at kkenow@usgs.gov (Ecosystems).

- Kenow, K. P., L. J. Fara, S. C. Houdek, B. R. Gray, D. J. Heard, M. W. Meyer, T. J. Fox, R. J. Kratt, S. L. Ford, A. Gendron-Fitzpatrick, and C. L. Henderson, In-Press, Migration Patterns and wintering distribution of common loons breeding in the Upper Midwest: Journal of Avian Biology, <https://doi.org/10.1111/jav.02609>.

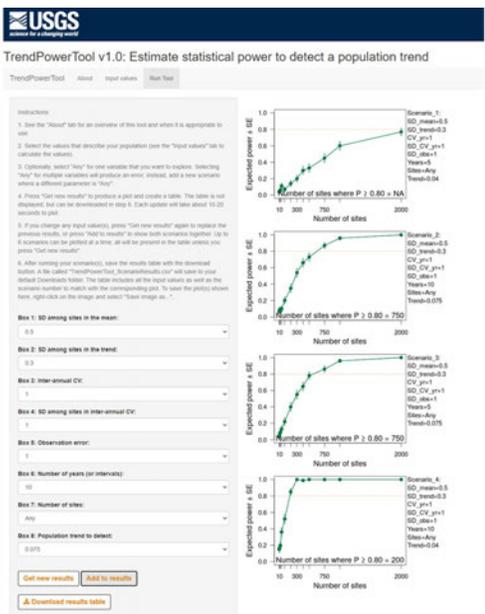


Migration patterns of adult common loons (*Gavia immer*; n = 109) breeding in Minnesota, Wisconsin and the Upper Peninsula of Michigan, with respect to passage through Lake Michigan. Blue lines represent movement from breeding grounds to Lake Michigan, green arrows represent movements made within Lake Michigan, red lines represent movements to wintering areas. Widths of arrows are proportional to the number of loons represented

Paths to Computational Fluency for Natural Resource Educators, Researchers, and Managers

Scientists at the USGS Upper Midwest Environmental Sciences Center, Science Analytics and Synthesis, and Columbia Environmental Research Center were invited to write a perspective on what computational approaches are needed for natural resources. Their invited perspective to the journal Natural Resources Modelling describes what tools and approaches they have observed as being necessary for natural resources practitioners and scientist to conduct research and represent natural systems within the computer's environment. The paper outlines a path for computational fluency including using open source tools when possible; reproducible data management, statistics, and modeling; understanding and applying the benefits of basic computer programming to carry out more complex procedures; tracking code with version control; working in controlled computer environments; and using advanced computing resources. Access to the paper is available online at <https://onlinelibrary.wiley.com/doi/10.1111/nrm.12318>. For more information contact Richard Erickson at rerickson@usgs.gov (Ecosystems).

- Erickson, R. A. , J. L. Burnett, M. T. Wiltermuth, E. A. Bulliner, L. Hsu, In-Press, Paths to computational fluency for natural resource educators, researchers, and managers. Natural Resource Modeling. 2021.34:e12318. DOI: 10.1111/nrm.12318



TrendPowerTool: A Lookup Tool for Estimating the Statistical Power of a Monitoring Program to Detect Population Trends

Scientists at USGS Alaska Science Center, Upper Midwest Environmental Sciences Center, and Geosciences and Environmental Change Science Center, and The University of Arizona developed a new tool for designing monitoring programs and coauthored a publication introducing the tool. Carefully designing monitoring programs can help ensure that the program’s goals are met, but can be technically and computationally demanding. TrendPowerTool is a new web-based lookup app that allows users to explore the potential consequences of a wide variety of monitoring designs and biological parameters. The tool is available at <https://www.usgs.gov/apps/TrendPowerTool/> and provides a quick and easy way to approximate the statistical power that a new monitoring program might have to detect a population trend. A copy of the paper is available online at, <https://doi.org/10.1111/csp2.445>. Access to the TrendPowerTool app can be found at <https://www.usgs.gov/apps/TrendPowerTool/>. For more information contact Emily Weiser at eWeiser@usgs.gov, or Wayne Thogmartin at wthogmartin@usgs.gov (Ecosystems).

Screenshot of the web-based user interface for TrendPowerTool. The user can choose up to six scenarios to display simultaneously, with the input values recorded to the right of each plot. A full results table can be downloaded. Other pages of the tool provide guidance for evaluating whether TrendPowerTool is appropriate for a specific program and for calculating input values.

- Weiser, E. L., J. E. Diffendorfer, L. López-Hoffman, D. Semmens, and W. E. Thogmartin, 2021. TrendPowerTool: A tool for estimating the statistical power of a monitoring program to detect population trends: Conservation Science and Practice, 2021;3:e445. DOI: 10.1111/csp2.445

Upper Mississippi River Restoration

Probabilities of Detecting Submersed Aquatic Vegetation Species using a Rake Method may vary with Biomass

Brian Gray evaluated whether occupancy ("percent frequency of occurrence") of submersed aquatic vegetation species estimated using data obtained with a common sampling method (a modified garden rake) might yield inaccurate estimates not only because it yields false negatives but also because the probabilities of those false negatives might vary with biomass, a variable that is rarely measured with rake data. Occupancy estimation requires that variation in detection probabilities be modeled. Probabilities of detecting species (given that they were present) were strongly associated with biomass. Sampling and computational methods that might circumvent this problem are described. A copy of the paper can be found online at <https://doi.org/10.1016/j.aquabot.2021.103375>. For additional information contact Brian Gray at brgray@usgs.gov (Ecosystems).

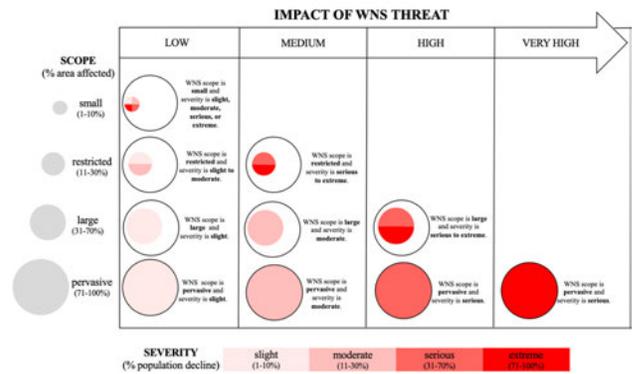


Minnesota DNR staff collect vegetation rake samples as one of six state-operated field stations in the Long Term Resource Monitoring element of the Upper Mississippi River Restoration.

- Gray, B.G., 2021, Probabilities of detecting submersed aquatic vegetation species using a rake method may vary with biomass. Aquatic Botany, 171:103375, DOI: 10.1016/j.aquabot.2021.103375.

Impacts of White-Nose Syndrome (WNS) on Cave-Hibernating Bats in Eastern North America

Wayne Thogmartin (UMESC), Brian Reichert (FORT), and collaborators from the U.S. Fish and Wildlife Service, National Park Service, U.S. Forest Service, 17 U.S. states, 2 Canadian provincial governments, Bat Conservation International, and 2 universities, has published the latest assessment of the impacts of White-Nose Syndrome (WNS) on cave-hibernating bats in eastern North America. Winter counts of three species undergoing species status assessment by the U.S. Fish and Wildlife Service (northern long-eared bat, little brown bat, tri-colored bat) were found to have declined by more than 90%, warranting classifying the severity of the WNS threat as extreme. The scope of the WNS threat was large to pervasive for these species. Declines for two other species (Indiana bat, big brown bat) were less severe but still qualified as moderate to serious severity. By uniting monitoring efforts across jurisdictional boundaries, this assessment demonstrated the importance of coordinated monitoring programs, such as the North American Bat Monitoring Program (NABat), for data-driven conservation assessments and planning. Access to the paper is found at <https://doi.org/10.1111/cobi.13739>. For more information contact Wayne Thogmartin (wthogmartin@usgs.gov) or Brian Reichert (breichert@usgs.gov).



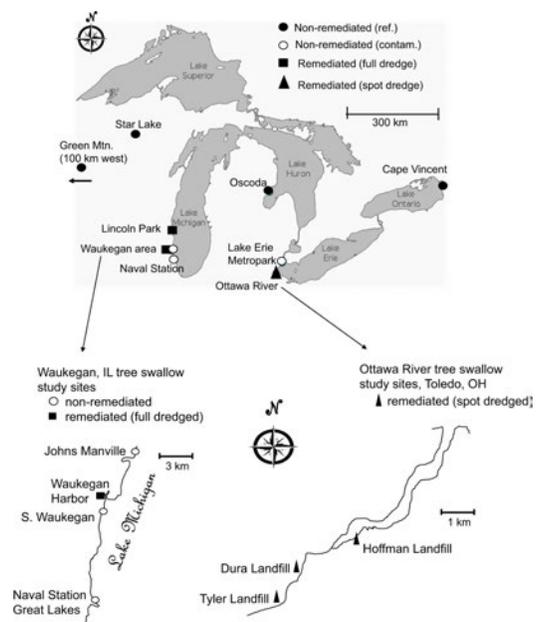
Framework from data collection to threat assessment, and NatureServe criteria used to assess the impact of the threat of white-nose syndrome (WNS).

- Cheng, T. L., J. D. Reichard, J. T. H. Coleman, T. J. Weller, W. E. Thogmartin, B. E. Reichert, A. Bennett, H. G. Broders, Campbell, K. Etchison, D. J. Feller, R. Geboy, T. Hemberger, C. Herzog, A. C. Hicks, S. Houghton, J. Humber, J. A. Kath, A. King, S. C. Loeb, A. Masse, K. M. Morris, H. Niederriter, G. E. Nordquist, R. W. Perry, R. Reynolds, D. B. Sasse, M. R. Scafani, R. C. Stark, C. W. Stihler, S. C. Thomas, G. G. Turner, S. Webb, B. Westrich, and W. F. Frick, In-Press, The scope and severity of White-nose Syndrome on hibernating bats in North America. *Conservation Biology*. 1-12. DOI: 10.1111/cobi.13739

Using Tree Swallows to Assess Reductions in PCB Exposure as a Result of Dredging

Christine Custer and coauthors' publication, "Using tree swallows to assess reductions in PCB exposure as a result of dredging at Great Lakes Restoration Initiative (GLRI) sites in the upper Midwest, US," is now available online in *Ecotoxicology*. This paper demonstrated that significant reductions in PCB exposure in tree swallows resulted from sediment dredging at several GLRI study sites in IL, OH, and WI. The type of dredging, either full or spot-dredging, reduced PCB exposure in tree swallows with the level of reduction dependent on the amount of contaminated sediment that was removed. An early release, online only, version of the paper is available at <https://doi.org/10.1007/s10646-021-02420-7>. For more information contact Christine Custer at ccuster@usgs.gov (Ecosystems).

- Custer, C. M., T. W. Custer, and P. M. Dummer, 2021, Using tree swallows to assess reductions in PCB exposure as a result of dredging at Great Lakes Restoration Initiative (GLRI) sites in the Upper Midwest, USA: *Ecotoxicology*, <https://doi.org/10.1007/s10646-021-02420-7>.



Map (upper) of remedy effectiveness study sites from across the Great Lakes Basin, 2008–2017 and closeups (lower) of northeastern Illinois study sites at Waukegan Harbor (lower left, remediated) and three non-remediated sites at differing distances from Waukegan Harbor, and from along the Ottawa River (lower right, remediated), Toledo, Ohio. Two types of non-remediated (reference and contaminated) sites and two types of dredged sites are indicated by different symbols

Other

Acronyms

DNR – Department of Natural Resources
DO – Dissolved Oxygen
DOI – Department of the Interior
ER – Ecosystem Respiration
FORT – USGS Fort Collins Science Center
GPP – Gross Primary Productivity
GRSM – Great Smoky Mountains National Park and Foothills Parkway
NABat – North American Bat Monitoring Program
NAJFM – North American Journal of Fisheries Management
NPS – National Park Service
PIERC – USGS Pacific Island Ecosystems Research Center
PCBs – Polychlorinated Biphenyls
SBSC – USGS Southwest Biological Science Center
TFM – 3-trifluoromethyl-4-nitrophenol
UMESC – USGS Upper Midwest Environmental Sciences Center
UMidWSC – USGS Upper Midwest Water Science Center
USFWS – U.S. Fish and Wildlife Service
USGS – U.S. Geological Survey
VMI – Vegetation Mapping Inventory
WNS – White-Nose Syndrome
