2016 Annual Report

Cooperating Agencies:
U.S. Geological Survey, Ecosystems
Iowa Department of Natural Resources
Iowa State University
U.S. Fish & Wildlife Service
Wildlife Management Institute
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Honors and Awards

Publications

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Graduate Committee Service

Professional Service
Personnel and Cooperators

Unit Coordinating Committee

Michael Tome
Units Supervisor
Cooperative Research Units
U.S. Geological Survey, Ecosystems

Sue Blodgett
Department Chair
Natural Resource Ecology & Management
Iowa State University

Dale Garner
Wildlife Bureau Chief
Iowa Department of Natural Resources

Patrick Ruble
Midwest Representative
Wildlife Management Institute

Joe Larscheid
Fisheries Bureau Chief
Iowa Department of Natural Resources

Craig Czarnecki
Assistant Regional Director
U.S. Fish & Wildlife Service

Unit Faculty & Staff

Robert W. Klaver
Unit Leader and Professor of Natural Resource Ecology & Management

Clay L. Pierce
Assistant Unit Leader, Fisheries, and Professor of Natural Resource Ecology & Management

Open Position
Assistant Unit Leader, Wildlife

Jessica Bell
Administrative Specialist II, Department of Natural Resource Ecology & Management

Graduate Students

Jalynn Almond, PhD. Student
Alexander Bybel, M.S. Student
Carlos Camacho, M.S. Student
Julia Dale, M.S. Student
Karri Folks, Ph.D. Student
Joe Lambert, M.S. Student
Nathan Mills, M.S. Student
Bridget Nixon, PhD Student
Nick Simpson, M.S. Student
Matt Stephenson, M.S. Student
Chris Sullivan, M.S. Student
Jennifer Swanson, M.S. Student
Courtney Zambory, M.S. Student

Collaborating Professors

Julie Blanchong, NREM
Diane Debinski, EEOB
Stephen Dinsmore, NREM
John Downing, EEOB
Frederic Janzen, EEOB
Joseph Morris, NREM, NCRAC
Michael Rentz, NREM
Kevin Roe, NREM/EEOB
Jennifer Vogel, EEOB
Michael J. Weber, NREM
Zhengyuan Zhu, Statistics
Northern long-eared bat monitoring

**Principal Investigator:** Julie Blanchong

**Student Investigator:**

**Collaborators:** Kelly Poole, Iowa Department of Natural Resources

**Duration:** April 22, 2015 to June 30, 2017

**Funding Source(s):** Iowa Department of Natural Resources (IDNR)

**Goals and Objectives:**
Conduct baseline studies including acoustic monitoring and telemetry studies to evaluate migratory movements and habitat use of the northern long-eared bat (NLEB) in Iowa.

**Progress:**
This is an acoustic monitoring and telemetry project to evaluate migratory movements and habitat use of the northern long-eared bat (NLEB) in Iowa. This species was recently listed as “Threatened” under the Endangered Species Act. The results of this work will be used by the Iowa Department of Natural Resources to support the development of a Habitat Conservation Plan (HCP) for wind power facilities in Iowa. A Research Associate to coordinate the project is being recruited and will be assisted by an ISU undergraduate student that has been working on another bat acoustic monitoring project. Technicians to deploy bat detection equipment and assist with telemetry are also being recruited. Bat detectors and associated equipment for recording echolocation data have been purchased.

**Future Plans:**
Bat detectors will be deployed at 120 sites across Iowa that are predicted based on GIS attributes to have suitable summer habitat for NLEB. Bat echolocation activity will be recorded for 2 nights at each site during June and July. Echolocation data will be analyzed to identify presence or probable absence of NLEB at each site using USFWS approved bat call identification software. Based on this analysis, a study site will be selected for a pilot telemetry project. Bats will be captured and fitted with transmitters by permitted bat biologists during late summer/early fall. Technicians will monitor bats using telemetry to identify roosting areas and timing and direction of NLEB fall migration. In late winter/early spring, bat detectors will be placed outside of several potential hibernacula to attempt to identify hibernacula used by NLEB.
Waterbird Responses to Iowa’s Shallow Lakes Restoration Program

Principal Investigator: Steve Dinsmore
Student Investigator: Rachel Vanausdall (M.S.)
Collaborators: Mark Gulick and Todd Bishop, Iowa Department of Natural Resources
Duration: August 1, 2015 to December 31, 2018
Funding Source(s): Iowa Department of Natural Resources (IDNR)

Goals and Objectives:
- Monitor migratory and breeding waterbird use at active shallow lakes restoration projects (pre-restoration, drawdown stage, and 1-5 years post-restoration) in Iowa during each of the two field seasons (2016 and 2017).
- Link waterbird responses to specific metrics of wetland condition and management actions to provide feedback in an adaptive resource management framework.
- Relate timing, rate, and duration of drawdowns to vegetation response that affects breeding and migratory bird use.

Progress:
In spring 2015 a M.S. graduate student (Rachel Vanausdall) was hired and she began coursework at Iowa State University in fall 2015. During fall 2015 we completed site selection, finalized plans for migration and breeding waterbird surveys, and developed a vegetation survey protocol.

Future Plans:
We will begin fieldwork in spring 2016. This will consist of weekly migration surveys at ~30 wetlands from mid-March through late May and then breeding bird point counts at all wetlands between late May and early July (2-3 visits per point). We will also sample vegetation at each wetland in early summer. In fall 2016 we will complete data entry for the first field season and begin preliminary analyses of the data.
Goals and Objectives:
Iowa Department of Natural Resources (Iowa DNR) participated in the AmeriCorps Program during the federal 2014 fiscal year (i.e., 1 October 2013 – 30 September 2014). The Corporation for National Community Service requires an evaluation of the effectiveness of the program. I was asked by Linda King, Program Director, Iowa DNR Keepers of the Land Program, to evaluate the short term outcomes of the program. I evaluated the amount of wildlife habitat improvement that occurred through the AmeriCorps Program.

Iowa had four AmeriCorps members working in fiscal year 2014 in Mills, Fremont, Webster, and Hamilton counties. In the fiscal year previous to the AmeriCorps participation a total of 69 acres of wildlife habitat improvement was completed for the four counties. The AmeriCorps members completed a total of 1904 acres in the four counties during fiscal year 2014. In fiscal year 2013, there were no AmeriCorps members and the four selected counties that received AmeriCorps had fewer acres than other counties without Private Lands Program staff. When the AmeriCorps members worked in their counties, they were nearly as successful as where Private Lands Program staff worked.

Summary:
In summary, Iowa DNR used AmeriCorps members in four counties during fiscal year 2014. These members developed 1836 acres of wildlife habitat improvement projects more than the previous fiscal year. In the fiscal year previous to the AmeriCorps grant, these four counties were among those with the least amount of habitat improvement. With the AmeriCorps grant, these four counties had projects nearly comparable to those with Iowa DNR Private Lands Project staff.
Monitoring protocol for otter and bobcat in Iowa

**Principal Investigator:** Robert W. Klaver  
**Student Investigator:** Bridget Nixon, (Ph.D.)  
**Collaborators:**  
**Duration:** January 2016 to May 2020  
**Funding Source(s):** Iowa Department of Natural Resources (IDNR), Drake University

**Goals and Objectives:**
- Comparing conventional population indices to statistical population reconstruction (SPR) to determine if the SPR model provides superior inferences that warrant its use as an otter and bobcat management tool.
- Performing SPR to provide estimates on otter and bobcat survival, age structure, recruitment, harvest, and population trends in Iowa.
- Using GIS to develop a river otter habitat suitability map for Iowa based on the number of otters trapped per HUC 12 watersheds as a function of land cover and landscape metrics comparable to the suitability map developed for the bobcats.
- Validating the habitat suitability map created in item 3.
- Evaluating the value of current data sources and simulating potential gains by including additional auxiliary data for use in managing Iowan furbearers.
- Publishing a final report and outlining recommendations to the Iowa DNR for future furbearer monitoring.

**Progress:**
This project will use otter tooth age data collected by the DNR since 2006 as part of the population characteristics used in the population reconstruction. These population characteristics, including sex, harvest data, and reproductive information, were compiled in early 2016 and are being evaluated for their use in the reconstruction. It was determined how many additional teeth need to be aged to make the age data more complete. A literature review was also started.

**Future Plans:**
- **Latrine surveys:** A pilot study in summer 2016 will proceed two full summer field seasons in which otter presence at latrines will be used as axillary data in the population reconstruction.  
- **Additional tooth aging:** Additional teeth, collected by the DNR, will be aged and added to existing tooth age data.  
- **SPR modeling:** Begin SPR work and continue to analyze population characteristics for use in model.
Boone River Watershed (BRW) Stream Fish and Habitat Monitoring, IA

**Principal Investigators:** Clay L. Pierce, Michael J. Weber, Kevin J. Roe  
**Student Investigator:** Nicholas Simpson (M.S.)  
**Collaborators:** Martin Konrad, Iowa Department of Natural Resources  
Karen Wilke, The Nature Conservancy  
Aleshia Kenney, U.S. Fish and Wildlife Service  
**Duration:** January 1, 2016 to December 31, 2017  
**Funding Source(s):** US Fish and Wildlife Service

**Goals and Objectives:**  
Fish assemblages and habitat conditions in two streams in the Boone River Watershed (BRW), White Fox Creek and Eagle Creek, will be monitored to evaluate their potential as Topeka shiner population sources and conduits for associated oxbow habitats. Eagle Creek and associated natural oxbows support the only known remnants of the Topeka shiner distribution in the BRW. Topeka shiners are presumed extirpated from the White Fox Creek sub-watershed, but five oxbows have been restored there for Topeka shiners and three of them have subsurface tile inflow for maintenance of water supply and nitrate sequestration. The success of restored oxbows for Topeka shiners is dependent on existence of populations in associated streams with suitable habitat. Our monitoring and assessment results will help guide present and future oxbow restorations and inform potential future Topeka shiner reintroduction to the BRW.

**Progress:**  
The graduate student, Nick Simpson, has been selected and plans are being made for the 2016 field season.

**Future Plans:**  
Field work will commence in April 2016.
Habitat Improvement Projects for Stream and Oxbow Fish of Greatest Conservation Need: Field Monitoring and Assessment

Principal Investigators: Clay L. Pierce, Kevin J. Roe, Michael J. Weber
Student Investigator: Alexander P. Bybel (M.S.)
Collaborators: Karen Kinkead, Iowa Department of Natural Resources
Todd Kolander, Minnesota Department of Natural Resources
Aleshia Kenney, U.S. Fish and Wildlife Service
Duration: January 1, 2016 to December 31, 2018
Funding Source(s): USFWS through the IA DNR

Goals and Objectives:
This project will focus on habitat restorations and responses of stream fish of greatest conservation need (SGCN), specifically Topeka shiners (Notropis topeka) and plains topminnows (Fundulus sciadicus). Extensive GIS analysis using a new, state-of-the-art framework will be undertaken to assist in guiding current and future restoration efforts. Monitoring of the fish populations in an adaptive management approach will be necessary to ensure fish are responding as expected to efforts to increase and improve their habitat. Additional SGCN potentially benefitting from the work include banded darters (Etheostoma zonale), blacknose shiners (Notropis heterolepsis), Iowa darters (Etheostoma exile), blackside darters (Percina maculate), longnose dace (Rhinichthys cataractae), slenderhead darters (Percina phoxocephala), slender madtoms (Noturus exilis), southern redbelly dace (Phoxinus erythrogaster), tadpole madtoms (Noturus gyrinus), and trout perch (Percopsis omiscomaycus). We will survey at least 20 sites in Iowa and Minnesota for Topeka shiners, plains topminnows, and habitat. Data will be collected on all fish species encountered. Genetic analysis of Topeka shiners and plains topminnows will be conducted through the use of microsatellite markers.

Progress:
The graduate student, Alex Bybel, has been selected and plans are being made for the 2016 field season.

Future Plans:
Field work will commence in April 2016.
Habitat Improvement Projects for Stream and Oxbow Fish of Greatest Conservation Need: Database and Landscape Analysis

**Principal Investigators:** Clay L. Pierce, Kevin J. Roe, Michael J. Weber

**Student Investigator:** Courtney Zambory (M.S.)

**Collaborators:**
Karen Kinkead, Iowa Department of Natural Resources
Todd Kolander, Minnesota Department of Natural Resources
Aleshia Kenney, U.S. Fish and Wildlife Service

**Duration:** January 1, 2016 to December 31, 2018

**Funding Source(s):** USFWS through the IA DNR

**Goals and Objectives:**
This project will focus on habitat restorations and responses of stream fish of greatest conservation need (SGCN), specifically Topeka shiners (Notropis topeka) and plains topminnows (Fundulus sciadicus). Extensive GIS analysis using a new, state-of-the-art framework will be undertaken to assist in guiding current and future restoration efforts. Monitoring of the fish populations in an adaptive management approach will be necessary to ensure fish are responding as expected to efforts to increase and improve their habitat. Additional SGCN potentially benefitting from the work include banded darters (Etheostoma zonale), blacknose shiners (Notropis heterolepsis), Iowa darters (Etheostoma exile), blackside darters (Percina maculate), longnose dace (Rhinichthys cataractae), slenderhead darters (Percina phoxocephala), slender madtoms (Noturus exilis), southern redbelly dace (Phoxinus erythrogaster), tadpole madtoms (Noturus gyrinus), and trout perch (Percopsis omiscomaycus). Species occurrence databases from both states will be compiled and combined to reveal locations where the two species have been documented as occurring. Minnesota’s Watershed Health Assessment Framework (WHAF) will be used in MN portions of the project area, and WHAF will be implemented in Iowa portions utilizing existing geospatial resources.

**Progress:**
The graduate student, Courtney Zambory, has been selected and she has begun compiling species occurrence databases and GIS resources to guide planning for the 2016 field season.

**Future Plans:**
Database construction and analysis and landscape analysis will proceed in 2016.
Prioritizing Habitats within Iowa to Manage for Priority SGCN

Principal Investigator: Zhengyuan Zhu
Student Investigator: Xiaodan Lyu
Collaborators: Karen E. Kinkead, Iowa Department of Natural Resources
Stephen J. Dinsmore, Natural Resource Ecology and Management, Iowa State University
Kevin T. Murphy, Natural Resource Ecology and Management, Iowa State University
Tyler M. Harms, Center for Survey Statistics and Methodology
Steven Roberts, Center for Survey Statistics and Methodology

Duration: 1 October 2015 – 30 June 2016
Funding Source(s): U.S. Fish and Wildlife Service

Goals and Objectives:
The objectives of this project were as follows:

- Use the Multiple Species Inventory and Monitoring (MSIM) Program occupancy models to create predictive species maps for priority Species of Greatest Conservation Need (SGCN).
- Create an occurrence layer showing the areas (based upon landscape variables) in Iowa that are predicted to have the highest density of SGCN.

Progress:
The Iowa Comprehensive Wildlife Action Plan was completed in 2005 as a guide for management of wildlife and their habitats across the state and was recently revised with the use of updated information. The Plan not only focuses on “keeping common species common” but also identifies Species of Greatest Conservation Need (SGCN). In an effort to gather more information on all wildlife in Iowa, particularly SGCN, the Iowa Department of Natural Resources (Iowa DNR) and Iowa State University designed and implemented the Multiple Species Inventory and Monitoring (MSIM) Program in 2006. This program annually conducts standardized surveys for wildlife species of nine taxonomic groups on public properties across Iowa. The Iowa DNR partnered with the Center for Survey Statistics and Methodology (CSSM) at Iowa State University to develop predictive occurrence maps for SGCN using data from the MSIM Program as an effort to prioritize areas of conservation action for SGCN.

Using species occurrence data for 291 sites surveyed as part of the MSIM program from 2006 – 2014, we evaluated the influence of landscape habitat characteristics on the probability of occupancy and probability of colonization for 59 SGCN using robust design occupancy models in Program MARK. Using the habitat covariate from the best model for each SGCN and estimated habitat characteristics for all of Iowa, we developed a predictive map of both probability of occupancy and colonization for each SGCN.

Conclusions and Recommendations:
An interactive web application was developed to display predictive maps and parameter estimates for each SGCN. This web application will be available to researchers and managers across Iowa to aid in focusing conservation efforts for SGCN. We also developed occurrence layers for each taxonomic group (e.g., birds) that displays areas of highest density of SGCN. All predictive models tested with acceptable levels of accuracy.

The web application will be hosted by CSSM for use by researchers and managers for 1-2 years.
Continuing Projects
Acoustic Monitoring for Iowa Bats

**Principal Investigator:** Julie Blanchong

**Student Investigator:**

**Collaborators:**
Kelly Poole, Iowa Department of Natural Resources
Stephanie Shepherd, Iowa Department of Natural Resources

**Duration:**
June 1, 2015 – January 31, 2017

**Funding Source(s):**
Iowa Department of Natural Resources (IDNR)

**Goals and Objectives:**
Conduct acoustic surveys along drive transects and in fixed-locations to monitor bat activity

**Progress:**
White Nose Syndrome (WNS), a devastating disease associated with the mortality of millions of bats, was first documented in New York during the winter of 2005-2006, and is now confirmed in Iowa. The loss of large numbers of bats due to WNS is expected to have enormous economic impacts to agriculture. Knowledge of the abundance and distribution of bat species in Iowa is minimal, but is critically needed to understand the potential ramifications of WNS to Iowa. Bat acoustic monitoring has been conducted for the past three summers along transects in eastern, central and southern Iowa. In summer 2015, we worked with the Iowa Department of Natural Resources (IDNR) to recruit and train volunteers to conduct the acoustic surveys. Relying on well-trained local volunteers to conduct the drive transects was efficient and cost effective. It also increased public engagement with the project and public awareness of bats and the threat of WNS. Citizen scientists collected bat echolocation data on 19 drive transects in central, eastern, and southern Iowa and 6 walking transects in central Iowa. Each transect was surveyed run twice during June and July. Similar to previous years, bat activity on drive transects was higher in Eastern and Southern Iowa than Central Iowa. Bat activity was higher at parks than at farms in Central Iowa. Regional differences in the percentage of "low" and "high" frequency bats were similar to findings in 2013 and 2014. Specifically, in Central and Southern Iowa, bats in the low frequency group, consisting of big brown, hoary, and silver-haired bats, were most commonly recorded. In the Eastern region, bats in the high frequency group, consisting of Eastern red, evening, Indiana, little brown, northern long-eared, and tricolored bats, were most commonly recorded.

**Future Plans:**
We will continue to conduct drive transect and walking surveys along established routes during summer 2016 to record echolocation calls. As in summer 2015, the IDNR will recruit volunteers to conduct the surveys. ISU will hold orientation sessions to train volunteers how to conduct surveys, teach them how to use the equipment, and show them how to keep appropriate records. ISU will continue to be responsible for analyzing the data collected by the volunteers to quantify bat activity and identify bat species.
Adaptive Management in Working Landscapes to Provide Habitat for Species of Greatest Conservation Need

Principal Investigators: Diane M. Debinski  
James R. Miller (University of Illinois)  
Walt Schacht (University of Nebraska, Lincoln)  
Lois Wright-Morton

Student Investigators: David Stein (M.S.)  
Callie Griffith (M.S. University of Nebraska, Lincoln)  
Jaime Coon (Ph.D. University of Illinois)

Duration: Nov. 15, 2013 to March 30, 2017

Funding Source(s): Iowa Department of Natural Resources (IDNR), State Wildlife Grant Comp.

Goals and Objectives:
- We will develop and implement best management practices for reducing or eliminating invasive plant species on lands owned or managed by Iowa Dept. of Natural Resources (IDNR) and Missouri Dept. of Conservation (MDC) to improve habitat conditions for Species of Greatest Conservation Need and other grassland dependent wildlife.
- We will engage private landowners in grassland management for benefit of Species of Greatest Conservation Need.

Progress:
This project builds on an experiment that began in 2006 that was designed to compare plant, insect, and bird responses to three types of grassland management in Grand River Grasslands of southern Iowa: 1) patch-burn graze, 2) graze-and-burn, and 3) burn-only. Twelve pastures, four of each treatment type, served as study sites in our efforts to assess the effectiveness of patch-burn grazing in improving habitat for grassland Species of Greatest Conservation Need (SGCN). In this new research, our goal is to test the use of adaptive management to reduce the cover of tall fescue (Schedonorus phoenix Scop.) within pastures. Tall fescue is a cool-season, high-moisture bunchgrass that was imported from Eurasia to the United States in the late 1800s for pasture improvement and erosion control. Although tall fescue is considered a valuable forage species, it can reduce domestic livestock performance. Alkaloids produced by endophyte-infected tall fescue are of low palatability to ungulates such as cattle, deer and elk and they may be toxic to small mammals and insects. Many ground-nesting birds are unable to use tall fescue fields as foraging or nesting habitat. The use of fire in grassland management is also complicated by the early green-up of tall fescue.

In this project the patch-burned graze pastures serve as “controls” and their responses is being compared to the graze-and-burn pastures where a Collaborative Adaptive Management (CAM) approach is employed. On the patch-burn graze sites, no herbicides are applied. On the graze-and-burn sites, each pasture is divided into three patches where different seed and herbicide treatments are applied. In both the patch-burn grazing and the burn-and-graze treatments, there are two grazing regimes: intensive early stocking (IES) and conventional stocking. Under IES, stocking density (number of cattle per unit area) is doubled and the grazing season is halved (April 1 to July 1) relative to conventional stocking. This approach will allow us to identify best management practices capable of converting fescue-dominated pastures to more diverse native grasslands. We expect that the highest probability of success will be accomplished by placing heavy grazing pressure on fescue early in the growing season and providing a late-season grazing deferment to benefit native warm-season grasses and forbs. This project involves research on state-owned and privately owned lands in Iowa and Missouri. The overall goal of CAM is to increase adaptation capacity and learning within the community of landowners and natural resource professionals.

Future Plans:
We collaborated with Iowa DNR and Missouri Dept. of Conservation, and the Nature Conservancy to select research sites and treatments in 2014 and since then have completed two field seasons of treatments and data collection. Our third field season is underway, including planning meetings in May, 2016 with all of the collaborators involved in this project.
Iowa Multiple Species Inventory and Monitoring (MSIM) Program

**Principal Investigator:** Steve Dinsmore  
**Student Investigator:** Shane S. Patterson (M.S.)  
**Collaborators:** Karen E. Kinkead, Iowa Department of Natural Resources  
Kevin Murphy, Research Associate, Iowa State University  
**Duration:** July 2015 to June 2018  
**Funding Source(s):** Iowa Department of Natural Resources (IDNR), State Wildlife Grant

**Goals and Objectives:**
- Conduct MSIM surveys for birds, mammals, amphibians, reptiles, fish, mussels, butterflies, odonates, and crayfish on 50 Wildlife Management Areas annually during 2015-2018.
- Enter collected data into the MSIM on-line database, submit county occurrence records to the appropriate Iowa WAP taxonomic subcommittee, provide additionally requested information to the IWAP subcommittees as requested, and change database records as advised.
- Analyze data using (but not limited to): Proportion of area occupied and species density (where applicable) using habitat variables from the field and/or GIS where applicable.

**Progress:**
This monitoring effort serves as the monitoring effort to complement the Iowa Wildlife Action Plan (IWAP, 2012). The Iowa Wildlife Action Plan lists 313 species of mammals, birds, reptiles, amphibians, fish, mussels, dragonflies, butterflies, and terrestrial snails as species of greatest conservation need (SGCN). We expect that the 2015 Revision of the plan will also include crayfish. The IWAP also states that one of the primary conservation actions is to ‘develop scientifically reliable knowledge on the distribution, abundance, and ecological needs of all wildlife species” (IWAP, page 107). These protocols have been deployed in 98 of the 99 Iowa counties (we have been flooded out of the site in Humboldt County in multiple years). The evaluation of the MSIM Program (under #T-6-R-5) determined that we should be surveying 50 properties each year (as opposed to the 26 we have been doing). These 50 Wildlife Management Areas are randomly chosen yet stratified such that each Wildlife Management Unit has at least 3 properties within the program.

**Future Plans:**
The specific goals for this project cycle are:
3. Enter collected data into the MSIM on-line database, submit county occurrence records to the appropriate Iowa WAP taxonomic subcommittee, provide additionally requested information to the IWAP subcommittees as requested, and change database records as advised.
4. Analyze data using (but not limited to): Proportion of area occupied and species density (where applicable) using habitat variables from the field and/or GIS where applicable.
Missouri River Multiple Species Inventory Monitoring

**Principal Investigator:** Steve Dinsmore  
**Student Investigator:** Five undergraduate field technicians  
**Collaborators:** Karen Kinkead, Iowa Department of Natural Resources  
**Duration:** March 15, 2015 to June 30, 2017  
**Funding Source(s):** Iowa Department of Natural Resources (IDNR)

**Goals and Objectives:**
- Collect baseline information on vertebrates and invertebrates in accordance with the Multiple Species Inventory and Monitoring (MSIM) protocols at 15-20 sites along the Missouri River.
- Estimate probability of occupancy and abundance for select species of interest, as appropriate.
- Link findings to the Missouri River Recovery Program (MRRP) objectives for these sites.

**Progress:**
Fieldwork for this project began in mid-April 2015 with the hiring of a field crew and site selection. A 5-person crew surveyed from 15 April to 15 October in 2015 collecting wildlife and habitat data for 15 study sites on 7 properties in southwest Iowa (Monona, Mills, and Fremont Counties). All species observed during surveys were recorded with special focus given the Species of Greatest Conservation Need (SGCN). All collected data were entered into the MSIM online database. Field study sites were selected based on specific habitat types and management practices of interest to state agency wildlife management staff that conduct habitat management on selected properties.

The specific goals for this project are:
1) Collect baseline information on vertebrates and invertebrates in accordance with the Multiple Species Inventory and Monitoring (MSIM) protocols at 15-20 sites along the Missouri River.
2) Estimate probability of occupancy and abundance for select species of interest, as appropriate.
3) Link findings to the Missouri River Recovery Program (MRRP) objectives for these sites.

Objective 1: Collect baseline information on vertebrates and invertebrates in accordance with the Multiple Species Inventory and Monitoring (MSIM) protocols at 15-20 sites along the Missouri River.
- We conducted surveys using MSIM protocols at 15 study sites on 7 properties: Blackbird Bend WMA, Auldon Bar, Tieville Bend WMA, Upper Decatur Bend WMA, St. Mary’s Island WMA, Nottleman Island WMA, and Copeland Bend WMA (Figure 1).
- We documented 150 species of birds (38 SGCN), 49 species of butterflies (XX SGCN), 26 species of mammals (4 SGCN), 15 species of fish, 51 species of odonates (4 SGCN), and 23 species of herpetofauna (15 SGCN).
- In addition to the diversity of wildlife encountered during the 2015 season there were many noteworthy sightings. We encountered Plains Spadefoot at 3 separate sites during the season, as well as documenting a Franklin’s Ground Squirrel, a species that has experienced significant declines across Iowa and the Midwest.

Objective 2: Estimate probability of occupancy and abundance for select species of interest, as appropriate.
- Analyses of these data are ongoing with further field efforts planned for 2016.

Objective 3: Link findings to the Missouri River Recovery Program (MRRP) objectives for these sites.
- Field efforts in 2015 will provide increased spatiotemporal coverage and better insight into wildlife occupancy and abundance patterns in the study area. Analyses of these data will be ongoing to help guide efforts to meet MRPP objectives on these sites.

**Future Plans:**
Fieldwork will resume on 15 April 2016 and continue through 15 October 2016. Plans are to survey ~15 study sites during this field season. At the end of the field season we will ensure all data are entered into the MSIM database, produce an annual report, and work with partners to provide analyses for select species of interest to meet management objectives.
Northeastern Iowa Goat Prairie Monitoring

**Principal Investigator:** Stephen J. Dinsmore  
**Student Investigator:** One undergraduate field technician  
**Collaborators:** Katy Reeder, Iowa Department of Natural Resources  
**Duration:** March 25, 2015 to November 30, 2017  
**Funding Source(s):** Iowa Department of Natural Resources (IDNR)

**Goals and Objectives:**
- Monitor reptiles and butterflies with Multiple Species Inventory and Monitoring (MSIM) protocols to gauge responses to goat prairie restoration.
- Survey for reptiles and butterflies with Visual Encounter Surveys (VES) and reptiles with coverboards.
- Collect baseline vegetation data before and after site restoration.

**Progress:**

**Task 1.** In consultation with the Iowa DNR Project Manager we selected a total of 44 goat prairies in northeastern Iowa for surveys.

**Task 2.** We hired one seasonal field technician in April 2015 to sample herptiles and butterflies at each site during the summer sampling period (mid-April through mid-October). This field technician (Tamathy Stage) was hired for her expertise in herptiles and butterflies. Because surveys were directed at specific rare taxa the protocols were implemented conservatively with respect to allowable survey conditions. This was done to maximize the detection probability of these rare taxa. These protocols, coupled with high local precipitation and low local temperatures, caused some delays in beginning surveys. This was especially true for butterflies because they are disproportionately reliant on appropriate temperatures for flight activity.

**Task 3.** Herptile surveys were intended to sample the entire herptile community through the use of Visual Encounter Surveys (VESs). We met our goal of conducting 3-4 surveys per site, with a total of 224 surveys conducted between 7 May and 14 October 2015. We detected a total of 201 individuals of 13 species (Table 1). Species with the greatest number of detections included Timber Rattlesnake (94), Five-lined Skink (21), and American Toad (14). The number of detections of Timber Rattlesnakes was especially impressive as this species is generally considered uncommon in this region. The skink and racerunner were also notable finds, but the number and diversity of snakes was a little disappointing.

**Task 4.** Butterfly surveys were focused during the primary summer flight season for most species. There were no significant weather delays for butterfly surveys like those in 2013. We completed 123 butterfly single visual encounter survey at 43 goat prairies (1 site was missed) in the period 17 May through 14 October 2015 and documented 805 individuals of 50 species across all sites. Species with the greatest number of detections included Great Spangled Fritillary (30 detections of 97 individuals), Little Wood-Satyr (27 detections of 122 individuals), Monarch (21 detections of 64 individuals), Clouded Sulphur (19 detections of 69 individuals) and Hackberry Emperor (12 detections of 30 individuals). The only target species found were Silvery Blue and Striped Hairstreak, each at one site.

**Task 5.** We were also able to complete vegetation surveys at 38 of 44 surveyed sites (6 sites were missed due to access issues at the end of the season). We measured tree basal area, canopy closure, shrub cover percentage as well as the presence of specific vegetation types that are of interest due to their value as either larval host or food resources for focal butterfly species. We did not detect Pale Purple Coneflower or Polar within any of our vegetation sampling plots, conversely we detected grass in all 38 sites surveyed, oak spp. in 25 of 38 sites surveyed, and Columbine spp in 14 of 38 sites surveyed. Because management actions are ongoing on these sites we will also be able to compare vegetation composition at these sites in our planned 2017 field season to document vegetation community change and examine how that may impact the occurrence of focal wildlife species at these sites.

**Task 6.** For each taxonomic group surveyed (herpetofauna and butterflies) I selected a small number of species with sufficient data for site occupancy analyses. Collectively, these analyses provide some insight into the distribution of each species across the sampled sites, and also result in estimates of their detection probability.

**Future Plans:**
After the 2015 field season is completed we began some initial analyses of site occupancy and detection probability for selected reptile and butterfly species. There will be no fieldwork in 2016 to allow sufficient time for restoration efforts before a second (and final) field season in 2017.
Silver Lake (Palo Alto County) Restoration and Feasibility Study

Principal Investigator: John Downing
Student Investigator: Collaborators: Christopher Filstrup and Clayton Williams
Duration: April 1, 2014 to November 30, 2016
Funding Source(s): Iowa Department of Natural Resources (IDNR)

Goals and Objectives:
To provide the Iowa Department of Natural Resources with a diagnostic and feasibility study of Silver Lake, Palo Alto County, Iowa for planning and implementing lake and watershed improvement efforts.

Progress:
Silver Lake monitoring activities for lake, tributary, and outfall locations were completed in January 2016. We have completed all physical, chemical, and biological analyses of water samples collected for the project. We are currently analyzing the dataset for the diagnostic study and identifying restoration alternatives for improvement of lake water quality. We hosted the second local steering committee meeting in March 2016 to discuss findings from the diagnostic study.

Future Plans:
We will submit the final diagnostic study report and recommendations for the feasibility study to Iowa DNR by September 30, 2016. With the help of Iowa DNR, we will coordinate a public meeting and two local steering committee meetings during Summer through Autumn 2016 to present findings from this study to the public and to develop effective restoration strategies with community leaders, respectively.
Developing a Model to Predict Canada Goose Breeding Pair Densities in the Midwest Using National Wetlands Inventory Data

**Principal Investigator:** Robert Klaver  
**Student Investigator:** Brenna Towery (M.S.)  
**Collaborators:**  
**Duration:** January 2013 to September 2017  
**Funding Source(s):** Iowa Department of Natural Resources (IDNR); U.S. Geological Survey

**Progress:**
Updated measurements of Canada goose distribution and nest survival are essential to develop and evaluate management strategies. Iowa’s protocols for monitoring the Canada goose breeding population use a stratified random sampling method to select square-mile sections to be surveyed by helicopter. Precise population estimates require that the universe of survey plots be accurately stratified. I provided a more statistically rigorous method of stratifying Iowa’s square-mile sections by developing a model to predict Canada goose breeding pair densities by incorporating updated National Wetlands Inventory data and previous breeding population survey data. I found that breeding pairs were best predicted by the wetland types, number of wetlands, area of each wetland type, and a quadratic of the area of each wetland type in each section, as well as an interaction between the wetland types and the area of each wetland type, and random effects for observations and sections. The model indicated that goose densities are highest at large semi-permanent marshes.

Reliable estimates of Canada goose nest survival allow management agencies to evaluate available nesting habitats and determine appropriate management techniques. I monitored Canada goose nests at five state-managed wetland complexes to determine how nesting habitat influenced nest survival rates at rural wetlands in north-central Iowa. I found that nest structures produced significantly higher nest survival than nests on islands and muskrat houses. I also found that shallow lake renovation activities at Rice Lake Wildlife Management Area, which involved manipulating the water level, had a negative impact on Canada goose nest survival.

**Future Plans:**
The project has been completed. Future plans are to submit three manuscripts to the Journal of Fish and Wildlife Management, Prairie Naturalist, and Wildlife Society Bulletin.
Grassland bird and invertebrate response to grassland diversity in restored plantings in northwestern Iowa

**Principal Investigators:** Robert W. Klaver
Jennifer A. Vogel

**Student Investigator:** Joseph Lambert (M.S.)

**Collaborators:** Iowa Department of Natural Resources, U.S. Fish and Wildlife Service

**Duration:** January 2015 to August 2017

**Funding Source(s):** Iowa Department of Natural Resources, U.S. Fish and Wildlife Service

**Goals and Objectives:**
- Compare breeding bird use of five habitat types that have been established on managed land in the Spring Run Wetland Complex (Spring Run).
- Compare vegetation composition and structure in each of the five established habitat types at Spring Run.
- Compare invertebrate populations in each habitat type at Spring Run.

**Progress:**
This project builds on a study that began in 2006 that was designed to compare bird response to four recently established habitat types within the Spring Run Wetland Complex in northwestern Iowa. The four habitat types were: (1) monotypic, introduced grass (smooth brome) with scattered legumes, (2) a five-grass mix of native tall-grass species, planted before 2004, (3) a five-grass mix of native tall-grass species, planted in 2005-2007, and (4) a diverse mixture of grasses and forbs, planted with over 40 species, planted in 2005-2011.

The goal of this study is to compare grassland bird response in established fields that are more indicative of the long-term conditions in an area. Therefore, the same four habitat types will be used in the study. An additional habitat type consisting of a mix of short-grass species and forbs, planted with over 100 species, will also be incorporated into this project. Understanding invertebrate populations within the area will be helpful in explaining bird abundance.

Bird surveys, vegetation surveys, and invertebrate surveys were completed in 2015. Thirty-five species of birds were identified using restored habitat in the Spring Run Wetland Complex in 2015. Common yellowthroat (**Geothlypis trichas**), bobolink (**Dolichonyx oryzivorus**), red-winged blackbird (**Agelaius phoeniceus**), and sedge wren (**Cistothorus platensis**) were the most common species observed. Invertebrate samples have been sorted to Order and are in the process of being dried and weighed.

**Future Plans:**
- **Bird surveys:** Surveys will take place weekly for six weeks during the summer of 2016 along line-transects.
- **Vegetation surveys:** Surveys will take place in June and July during the summer of 2016 along randomly located transects in each habitat type.
- **Invertebrate surveys:** Sweep-net sampling will take place on randomly located transects during May, June, and July during the summer of 2016.
Amphibian Occupancy and Effects of Habitat Use on Chemical Exposure in Northern Leopard Frogs (Lithobates pipens) in Iowa Prairie Pothole Wetlands

**Principal Investigator:** Clay L. Pierce  
**Student Investigator:** Jennifer Swanson (M.S.)  
**Collaborators:** Erin Muths, U.S. Geological Survey  
Mark Vandever, U.S. Geological Survey  
Kelly Smalling, U.S. Geological Survey  
**Duration:** January 1, 2015 to May 31, 2017  
**Funding Source(s):** U.S. Geological Survey

**Goals and Objectives:**  
- Determine amphibian occupancy rates in Iowa Prairie Pothole Region wetlands  
- Correlate wetland habitat characteristics with amphibian species presence or absence  
- Document post-breeding movement patterns of northern leopard frogs on Conservation Reserve Enhancement Program wetlands  
- Assess the effect of surrounding land use practices as they contribute to chemical exposure and concentrations in northern leopard frogs

**Progress:**  
A graduate student, Jennifer Swanson, has been selected and began classes in Spring of 2015. Jennifer completed the first season of field work between April and August 2015. Thirty-eight northern leopard frogs were radio tracked in two Conservation Reserve Enhancement Program wetlands. After tracking was completed, 18 of the frogs were euthanized and their bodies analyzed for pesticide content. Twenty-seven wetlands in northern Iowa were surveyed for all amphibian species four times each during the field season.

**Future Plans:**  
Jennifer will begin the second season of field work in April 2016 performing wetland surveys and radio tracking.
Reproductive ecology of Asian Carp in Southeastern Iowa rivers

Principal Investigators: Clay L. Pierce, Michael Weber  
Student Investigator: Carlos Camacho (M.S.)  
Collaborators: Kim Bogenschutz, Iowa Department of Natural Resources  
Jason Euchner, Iowa Department of Natural Resources  
Duration: July 1, 2013 to June 30, 2016  
Funding Source(s): Iowa Department of Natural Resources (IDNR)

Goals and Objectives:
o Evaluate Asian carp reproduction (fecundity, larval and juvenile densities) and recruitment in select Iowa rivers, including the Mississippi, Des Moines, Skunk, Iowa, and Cedar rivers.

Progress:
A combined total of 2,964 adult Asian Carp were collected from the Mississippi, Des Moines, Skunk, and Iowa rivers during the 2014 and 2015 sampling seasons. Gonadosomatic index of female Silver Carp peaked in May 2014 and 2015 and were lowest in July during 2014 and August during 2015. Spawning females were not captured in 2014 but were captured from April to June in 2015. Post-spawn females were observed starting in June with 93% of females exhibiting spent gonads in July 2014 and were present in all months sampled in 2015. Additionally, ichthyoplankton nets were used to capture 10,190 eggs and 38,868 age-0 fishes in 2014 and 5,929 eggs and 33,513 age-0 fishes in 2015 of unknown species from the Cedar, Iowa, Skunk, Des Moines and Mississippi rivers. Combined total of all egg densities from all species and across all locations peaked in late May through mid-June and the combined total of all age-0 fish densities from all species and across all locations were highest during mid-August in both years. Specifically, Asian Carp eggs were captured in the Mississippi River from late-May to mid-June and Iowa River on June 18th in 2014. Age-0 Asian Carp were captured in the Mississippi River from late-May to late-June, Skunk River on May 27th, and the Iowa River on June 18th in 2014. The highest densities of age-0 Asian Carp occurred within the tributaries near the confluence and immediately downstream of each confluence with the Mississippi River.

Future Plans:
Eggs and age-0 fishes collected in 2015 are still being processed for identification and will be completed in the spring of 2016. Ichthyoplankton data will be used to evaluate Asian Carp reproductive contributions in tributaries to the Mississippi River.
Asian Carp population dynamics and distribution in southeast Iowa rivers

Principal Investigators: Clay L. Pierce, Michael Weber
Student Investigator: Chris Sullivan (M.S.)
Collaborators: Kim Bogenschutz, Iowa Department of Natural Resources
                Jason Euchner, Iowa Department of Natural Resources
Duration: May 1, 2014 to June 30, 2016
Funding Source(s): Iowa Department of Natural Resources (IDNR)

Goals and Objectives:
- Evaluate influence of environmental covariates on occupancy and detection probabilities of Asian Carp
- Evaluate and compare temporal (e.g., seasonal and annual) trends in Asian Carp population characteristics (abundance, distribution, size structure, condition) and dynamics (growth, mortality, recruitment) among southeast Iowa tributaries and upper Mississippi River populations
- Evaluate patterns of large-scale spatial synchrony of dynamic rates (recruitment and growth) for Asian Carp populations among Midwestern Mississippi River watersheds.

Progress:
A total of 2,964 Asian Carp were collected in the Des Moines, Skunk, Iowa, and Mississippi rivers from April to October 2014/2015. The Des Moines River sites (below Lock and Dam 19 [LD19]) accounted for 99% of all Asian Carp captures, while the Skunk River (confluence site) accounted for only 0.01% of catch and only two Silver Carp were captured in the Iowa River. Silver Carp made up the majority of the catch (>97%) while Bighead Carp only comprised approximately 2% of captured individuals. Additionally, fourteen additional fish from the Des Moines River were identified as hybrid Asian Carp. Below LD19, Silver Carp ranged from 450 to 959 mm (mean = 665 mm) in length and 1.0 to 9.9 kg (mean = 2.9 kg) in weight. Bighead Carp ranged from 397 to 1110 mm (mean = 842 mm) in length and 0.7 to 13.7 kg (mean = 6.5 kg) in weight. Above LD19, only 33 Silver Carp were captured throughout the year ranging from 480 to 941 mm (mean = 829 mm) in length and 1.4 to 10.0 kg (mean = 7.1 kg) in weight. Proportional size distribution (PSD) indices suggest Silver Carp populations are of larger size structure in downstream sites compared to upstream sites while populations above LD19 are larger than populations below LD19. Additionally, age structures of both Silver and Bighead carp populations were similar across sites.

Future Plans:
Processing of zooplankton and chlorophyll-a will continue until completed. During spring, data collected during 2014/2015 will be analyzed and summarized into publishable manuscripts.
Genetic structure of the Iowa Pleistocene Snail (*Discus maccklintocki*).

**Principal Investigator:** Kevin J. Roe  
**Student Investigator:** Jermaine Mahguib (Ph.D.)  
**Collaborators:**  
**Duration:** September 15, 2012 – September 15, 2016  
**Funding Source(s):** Iowa Department of Natural Resources (IDNR)

**Goals and Objectives:**  
The objective of the project is to document genetic diversity, population structure, the extent of gene flow, and historical connections between populations of the Iowa Pleistocene Snail (*Discus maccklintocki*).

**Progress:**  
The PI identified a laboratory to assist with generating species specific microsatellite markers for *D. macclintocki*. The lab has produce 48 sets of microsatellite primers which will be screened in the lab of the PI to ascertain a suitable number of polymorphic loci. Once this has been established, the samples that have been obtained will be screened using these primers and the data will be analyzed.

**Future Plans:**  
The graduate student, Jermaine Mahguib will identify which of the 48 primer sets are for polymorphic loci this spring and summer (2016).  
All available samples obtained to this point will be screened for these markers (Summer/Fall 2016) and the data analyzed.
Conservation, Habitat Use, and Genetic Diversity of a Translocated Population of Greater Prairie-chickens in Iowa

Principal Investigator: Jennifer Vogel
Co-Principal Investigator: Diane Debinski
Collaborators: Stephanie Shepherd, Iowa Department of Natural Resources
Duration: 2013-2016
Funding Source(s): Iowa Department of Natural Resources (IDNR) – State Wildlife Grant
US Fish and Wildlife Service

Goals and Objectives:
1. Evaluate the genetic diversity of the small population of greater prairie-chickens in Iowa and examine the effects on genetic diversity of supplementing the current population with translocated birds.

2. Develop a habitat suitability model and examine habitat use for greater prairie-chickens in Iowa.

Progress:
Genetics: We collected 74 blood samples from translocated birds in 2013 and 109 blood samples from translocated birds in 2014. In addition, we collected 86 feather samples from the 2 active lek sites in Iowa in 2014 and 134 feather samples from the 2 lek sites in 2015. Blood and feather samples are being processed at the University of North Texas.

Telemetry: We attached a total of 25 ARGOS satellite/GPS transmitters to translocated prairie-chickens in 2013, 2014, and 2015. From these 25 birds, we downloaded over 12,000 GPS locations. We tracked birds through 4 different states (Iowa, Missouri, Kansas, and Illinois).

Habitat Model: Using 2009 HRLC data for the state of Iowa we extracted the percent cover of land cover categories within 1500m of each prairie-chicken GPS location and from a set of random points. To determine the probability of habitat use for prairie-chickens in Iowa, we analyzed the land cover data at the GPS locations and random points using a logistic regression model. The logistic regression model included 6 covariates where the individual F-tests were significant at the P<0.05 level. The model suggests a positive relationship with grassland and water; and a negative relationship with forest, roads, and shrubs. Using the equation from our logistic regression analysis, we created a habitat map illustrating the probability of habitat use by greater prairie-chickens in Iowa.

Future Plans:
We are currently working to apply the prairie-chicken habitat model to projected land cover change scenarios in Iowa based on global environmental change scenarios produced by the Intergovernmental Panel on Climate Change.
Factors Affecting Mercury Concentrations in Iowa Fishes

**Principle Investigators:** Michael J. Weber  
Clay L. Pierce  

**Student Investigator:** Nathan T. Mills (M.S.)  

**Collaborators:** Darcy Cashatt, and other Iowa DNR Staff  

**Duration:** June 1, 2014 to December 31, 2016  

**Funding Source(s):** Iowa Department of Natural Resources (IDNR)

**Goals and Objectives:**
- Develop regression models to predict the concentration of mercury in a range of fishes as a function of fish total length across natural lakes, impoundments, reservoirs, and rivers to guide consumption advisories.
- Evaluate regional (e.g., north vs south, east vs west) differences in mercury concentrations to help guide consumption advisories. Include additional biotic (e.g., age, food web dynamics) and abiotic (e.g., land use, water quality) factors in models to explain additional variation in mercury concentration not explained by fish length.
- Evaluate temporal changes in mercury concentrations in largemouth bass to guide mercury sampling protocols.

**Progress:**
DNR biologists and Iowa State University (ISU) personnel have been collecting fish from several lakes, reservoirs, and rivers across Iowa. As of March 2016, 277 bluegill, 207 black crappie, 112 white crappie, 63 yellow perch, 239 channel catfish, 160 flathead catfish, 179 smallmouth bass, 525 largemouth bass, 32 muskellunge, 21 sauger, 455 walleye, 132 northern pike, 14 freshwater drum, 36 hybrid striped bass, 46 white bass, 28 yellow bass, 10 brook trout, 11 brown trout, and 20 rainbow trout have been collected for mercury analysis. During the 2015 sampling season, ISU personnel boat-electrofished 23 days, totalling ~62 shocking hours at 18 different river sampling sites on the Des Moines, Iowa, Cedar, Wapsinicon, Maquoketa, and Upper Iowa rivers. In addition to fish sampling, approximately 40-50 man-hours were spent polywogging for freshwater mussels in these rivers.

The highest total mercury concentration detected was 2.52 mg/kg and was found in a 1204mm (47.4") female muskellunge from West Okoboji Lake, in northern Iowa, during April 2014. Of the ~2300 tissue samples that have been analyzed for mercury, only ~10% have had mercury concentrations exceeding the EPA criterion of 0.30 mg/kg. While ~40% of these samples have had undetectable mercury concentrations (<0.05 mg/kg).

Seasonal differences in largemouth mercury concentrations were found in Red Haw Lake, with the highest mean concentrations in July and lowest during October, 2014. However, no seasonal differences in largemouth mercury concentrations were found in Twelve Mile Lake, 2013.

**Future Plans:**
Fish and mussel stable isotope samples are currently being processed and analyzed at Iowa State University. Once all samples have been analyzed for mercury and stable isotopes, various statistical models will be created to identify biotic and abiotic influences on mercury accumulation in Iowa fishes. Spatial relationships and lake-by-lake or species-specific contamination concerns will be identified from these models to guide further development of Iowa consumption advisories.
Completed Projects
Genetic Analysis of White-tailed Deer Population Structure in Iowa: Identifying Potential Patterns and Rates of Disease Spread

**Principal Investigator:** Julie Blanchong  
**Student Investigator:** Lynne Gardner (Ph.D.)  
**Collaborators:**  
**Duration:** July 2011 to December 2015  
**Funding Source(s):** Iowa Department of Natural Resources (IDNR)

**Goals and Objectives:**
- Quantify the extent of deer population genetic structure across Iowa, and identify relationships between landscape features and genetic structure.
- Characterize levels and patterns of genetic diversity in deer in Iowa and other Midwest states.

**Progress:**
We received several thousand deer tissue samples collected for the Iowa Department of Natural Resource's CWD surveillance efforts. In addition, we obtained samples from several Midwest states. Deer selected for the project were genotyped at 10 microsatellite markers and the control region of mitochondrial DNA (mtDNA) was sequenced.

We found that white-tailed deer exhibited relatively weak genetic structure across Iowa. We detected very small associations between genetic structure and natural (i.e., amount of row crop agriculture, ecoregion) and anthropogenic (i.e., interstate highways) features of the Iowa landscape suggesting that they likely have minimal effects on deer movement.

We sequenced mtDNA of deer from 11 Midwest states, including Iowa. Deer in all states exhibited high levels of mtDNA diversity. We identified 15 different quite distantly related haplotype groups across the Midwest, the most frequent of which occurred in almost all states. In Iowa and the states immediately surrounding it, two haplotype groups predominated.

**Conclusions and Recommendations:**
Our findings suggest that, for the deer population in Iowa, landscape features likely have minimal effects on dispersal. Consistent with conclusions drawn in other investigations documenting weak genetic structure in deer in agricultural areas of the Midwest, it appears that the natural (deer-mediated) spread of disease will largely only be limited by the dispersal distance of deer.

Regionally, standing levels of mtDNA diversity are likely the result of the complex history of deer in the Midwest. Specifically, following a history of overharvest and local extirpation, relatively recent recolonization coupled with the high mobility of deer and their ability to adapt to a diversity of habitat types likely facilitated extensive spatial mixing of the diverse and highly differentiated lineages we observed across the 11 states.
Northeastern Iowa Forest Monitoring

Principal Investigator: Steve Dinsmore
Student Investigator: Two undergraduate field technicians
Collaborators: Katy Reeder, Iowa Department of Natural Resources
Duration: April 15, 2013 to June 30, 2016
Funding Source(s): Iowa Department of Natural Resources (IDNR)

Goals and Objectives:
- Monitor breeding birds with Multiple Species Inventory and Monitoring (MSIM) protocols to gauge responses to forest habitat management.
- Monitor butterflies with Visual Encounter Surveys (VES) to gauge responses to forest habitat management.

Progress:
Bird surveys were focused on sampling the breeding bird community, and we thus limited to the primary nesting season for Iowa (late May through early August). We repeated surveys in 2015, but with a total of 132 point counts in 44 stands in the period 19 May to 14 August detecting a total of 4,211 individuals of 72 species (Table 2). Species with the greatest number of detections in 2015 included American Crow (199), Northern Cardinal (164), and American Robin (159). However, surveys also detected 14 SGCN birds including Black-billed Cuckoo, Red-headed Woodpecker, Least Flycatcher, Bell’s Vireo, Wood Thrush, Blue-winged, Cerulean, and Hooded warblers, and Yellow-breasted Chat.

Butterfly surveys were focused during the primary summer flight season for most species. We repeated butterfly surveys in 2015 when we sampled 44 stands 3 times (132 total VES) in the period 22 May through 14 August and documented 607 individuals of 30 species across all sites (Table 4). Weather was more favorable than in 2013 with respect to flight seasons on most species. Species with the greatest number of detections included Red Admiral (36), Eastern Tiger Swallowtail (30), and Great Spangled Fritillary (24). No target species were found. Surveys detected 2 additional SGCN butterflies: Aphrodite Fritillary and Monarch. We also completed one vegetation survey per stand between 15 July and 20 August.

Conclusions and Recommendations:
This project is now complete and a final report has been submitted.
Twin Lakes Restoration Diagnostic and Feasibility Study

Principal Investigator: John Downing
Student Investigator: Christopher Filstrup and Clayton Williams
Collaborators: John Downing, Christopher Filstrup, Clayton Williams
Duration: October 1, 2013 to May 31, 2016
Funding Source(s): Iowa Department of Natural Resources (IDNR)

Goals and Objectives:
To provide the Iowa Department of Natural Resources with a diagnostic and feasibility study of North and South Twin Lakes, Calhoun County, Iowa for planning and implementing lake and watershed improvement efforts.

Progress:
All monitoring activities and physical, chemical, and biological analyses of water samples have been completed for the project. A draft of the final project report was submitted to Iowa DNR in April 2016. We hosted a local steering committee meeting in November 2015 to discuss project findings with the technical advisory team and local steering committee. Additionally, we hosted a public meeting in May 2016 to discuss project findings and restoration alternatives for North and South Twin Lakes with local stakeholders. The final project report will be submitted by May 31, 2016 and a final local steering committee meeting will be held in Autumn 2016 to discuss restoration alternatives with the technical advisory team and local steering committee.

Conclusions and Recommendations:
North and South Twin Lakes suffer from water quality problems associated with high nutrient and sediment loads originating in this predominantly agricultural watershed, although development around the lakes, especially North Twin Lake, can also contribute to these problems. Elevated phosphorus loads fuel phytoplankton (i.e., algae) growth, resulting in large amounts of phytoplankton that are dominated by potentially toxic Cyanobacteria (i.e., blue-green algae). Combined with phytoplankton in the water column, high amounts of inorganic suspended solids derived from the watershed, such as soil particles, reduce water transparency and lead to high sediment accumulation rates. Additionally, the lakes lack a diverse, healthy, and sustainable aquatic community. Poor water quality continues to plague the sport fishery of each lake, despite extensive management efforts to improve them.

To improve water transparency and the overall health of North and South Twin Lakes, efficient management strategies to reduce the amounts of nutrients and sediment entering the lakes from the watershed need to be developed. Because direct rainfall and dryfall of total phosphorus (TP) to the lakes cannot be effectively controlled, it is only possible to achieve maximum TP loading reductions of 80% for North Twin Lake and 70% for South Twin Lake. If these maximum targets are realized, water transparency are anticipated to improve by 2.5× in North Twin Lake (1.2 ft to 2.9 ft) and by 4× in South Twin Lake (0.6 ft to 2.5 ft). A cost-effective, comprehensive restoration strategy for North Twin Lake could involve 1) diverse BMPs targeting direct TP runoff from the unconsolidated watershed (i.e., area surrounding the lake), 2) creating a series of cascading detention ponds or wetlands near Featherstone Memorial County Park, and 3) reducing nutrient loading from tile drainage by routing tile drainage through treatment structure or re-routing tile drainage away from the lake. For South Twin Lake, a restoration strategy could involve 1) moving the outfall of North Twin Lake and routing it through a diked wetlands complex, 2) diverse BMPs targeting direct TP runoff from the unconsolidated watershed, and 3) enhancing the existing wetland complex near 230th street.
Midwest Mustelid Trends

**Principal Investigators:** Robert Klaver  
Michael Rentz  

**Student Investigator:**  
Collaborators:  

**Duration:** April 15, 2015 to March 31, 2016  

**Funding Source(s):** Iowa Department of Natural Resources (IDNR)

**Goals and Objectives:**
The core objective of the project was to determine the presence/absence of 3 weasel species in Iowa. We hoped to have high enough detection probabilities to determine coarse distribution. I also planned to use the results of this study to select locations for more intensive research in subsequent seasons, including snow tracking, mark-recapture, and possibly radio/gps collaring.

**Progress:**
All 48 sites had a single hair tube for at least 10 days, most the full 2 weeks. Nearly every tube showed visitation by mammals, in many cases mice (assume Peromyscus spp) and northern short-tailed shrew (Blarina brevicauda) based on tracks and scat. Thirty one sites had collectable hair on the brushes, 14 had no collectable hair, 1 trap is still in transit from a colleague who collected it in December, and 2 traps could not be found.

For the 31 traps with hair, we were able to rule out weasels in 14 cases (the hairs keyed out as belonging to rodents or shrews). A small number of samples consisted of only underhair, which could not be keyed out (5) or had hair that was damaged and could not be identified (2). In a further 2 cases hair was collected from the brush, but was lost during the transfer to the slides. In each case there was only a 1-2 hairs, likely of underhair. We identified 8 samples as containing hair from weasels.

**Conclusions and Recommendations:**
We were successful in designing and deploying 48 hair snares across the state of Iowa, and were able to recover 46 snares. All but the single tube collected by a colleague have been analyzed using the techniques outlined in the proposal. Although not part of the original objective, the grant allowed 6 ISU students to become involved in faculty research. The opportunity to be a valued team member in this way is invaluable to students.

We would like to submit the 8 weasel samples for DNA testing to determine if we can positively identify the species, as was the goal of this project. Identification to species using only the hair would require a destructive technique to create a reverse image cast of the cuticle. We will investigate this route if DNA sampling is not feasible due to low follicle numbers or if the samples have degraded.

We also plan to re-visit these sites during the next year to look for weasel sign, and begin to get an understanding of how the weasels are using the sites, and how many individuals may reside in the area. This will likely involve snow tracking to begin with, but may include more intensive efforts at non-invasive techniques such as track plates, more snares, or cameras. The extensive nature of the completed project will be helpful in identifying sites on which we can focus these efforts.

I have a new group of students who will be revisiting 2 of the sites (one with a weasel find and one without) and adding an additional 2 sites that were not surveyed. On these sites they will survey intensively, with a grid of 32 snares tubes, rather than a single tube. They hope to determine if the increased effort increases the likelihood of identifying a weasel, and if they can determine space use across the grid.
Urban Habitat Use by Butterflies: Adapting Protocols for Monitoring and Conducting Outreach with Place-based efforts.

**Principal Investigator:** Jan Thompson  
**Student Investigator:** Bret Lang (M.S.)  
**Collaborators:**  
**Duration:** April 15, 2015 to March 31, 2016  
**Funding Source(s):** Iowa Department of Natural Resources (IDNR)

**Goals and Objectives:**
The specific objectives of this project were to:
- determine the potential of urban gardens and natural areas embedded in urban settings in central Iowa to serve as habitat for butterflies, and to compare their ability to do so;
- compare modified transect and point-count survey protocols to evaluate the suitability of these protocols for assessing butterflies in urban habitats; and
- conduct initial outreach at Reiman Gardens and Ames High School (with Environmental Science faculty and students), by developing maps of butterfly habitat use and engaging volunteers/students in ongoing monitoring efforts using uniform protocols.

**Progress:**
Sites were surveyed starting in June and ending in September, 2015. Surveys were conducted between 10:00 am and 6:30 pm on sunny days with wind speeds less than 10 mph and temperatures between 70˚ and 95˚ F (Ries et al. 2001; IDNR nd). We conducted Pollard Walk transects, purposive point-count and random point-count surveys during each site visit.

**Conclusions and Recommendations:**
Each site was surveyed six times from June through September. Frequency of sampling was limited by cool, wet, weather conditions early in the season and windy conditions late in the season.

**Comparison of habitat types.** The number and proportions of butterfly sightings was influenced somewhat by both habitat type and survey method, with the greatest number of sightings occurring for purposive point surveys conducted in public gardens. Fewer sightings were documented using purposive point surveys in restored prairie areas, and for the two other survey methods in both habitat types.

However, no statistically significant differences were detected for number of sightings according to habitat. Similarly, total number of taxa observed was greatest in public gardens, but not statistically different.

**Comparison of survey methods.** Among survey methods, the greatest number and proportion of sightings were detected with purposive point surveys compared to other methods; the number of sightings detected using random point-count surveys were intermediate between the other two. The difference between purposive point counts and Pollard Walk transects was marginally detectable statistically before correcting for sampling effort (p = 0.056) using pairwise comparisons with a Tukey-Kramer test; after sampling effort adjustment the difference was not significant (p = 0.096).

**Taxa observed.** Across all sites, survey methods, and sample dates 1,093 sightings representing 28 species were documented. The most commonly encountered taxa were seen in both site types and included primarily disturbance-tolerant species: cabbage white, monarch, clouded sulphur, red admiral, and eastern-tailed blue. Least common species that were observed occurred somewhat more frequently in public gardens than in natural areas and included checkered white, clouded skipper, cloudless sulphur, coral hairstreak, hackberry emperor, least skipper, and Peck's skipper. Several habitat-sensitive species also were observed: regal fritillary, great spangled fritillary, tawny-edged skipper, gray copper, and silver-spotted skipper (species were categorized as per Ries et al. 2001, Shepherd and Debinski 2005, and Reeder et al. 2005).

**Initial outreach.** Project personnel have participated in one outreach event and one symposium to date. Additional outreach on site-specific results with project partners at most sites was delayed to allow completion of data collection and preliminary analysis, and is planned for spring and summer, 2016. These events will include on-site demonstrations of protocols, use of interactive “Story Maps” and distribution of fact sheets based on observations at each site.

**Additional planned project activities.** Because weather conditions limited data collection according to sampling criteria for ambient conditions during summer 2015, collection of four to six additional sample sets is planned for summer 2016.
Honors and Awards

Carlos Camacho (M.S. Student)
- John E. Skinner Memorial Award. 2015. Education Section, American Fisheries Society.
- AFS Introduced Fish Section Travel Grant. 2015. Introduced Fish Section, American Fisheries Society.
- GPSS Professional Development Grant (PAG). 2015. Graduate and Professional Student Senate, Iowa State University.
- NREM Travel Award. 2015. Department of Natural Resource Ecology and Management, Iowa State University.

Chris Sullivan (M.S. Student)
- John E. Skinner Memorial Award, Honorable Mention. 2016. Education Section, American Fisheries Society.
- Diamond Hitch Award. 2016 Department of Natural Resource Ecology and Management, Iowa State University.
- NREM Graduate Student Professional Development Travel Grant. 2016. Department of Natural Resource Ecology and Management, Iowa State University.
- Janice Lee Fenske Memorial Award, Finalist. 2016. Midwest Fish & Wildlife Conference.

Publications


Presentations


Professional Activities

Teaching/Learning Opportunities

Robert W. Klaver
- Fall 2015: Carnivore Conservation (EEB 698)

Clay L. Pierce
- Fall 2015: Stream Ecology (AEcl 518)
- August 2015: “Fish Population Analysis with FAMS” (2 day continuing education course for Iowa Chapter of American Fisheries Society)

Nicholas Simpson (M.S.)
- Spring 2016: Fish Biology (AEcl 321)

Graduate Committee Service

Robert W. Klaver
Advisor/Co-Advisor
- Jalynn Almond (Ph.D., Department of Natural Resource Ecology & Management, Iowa State University)
- James Crain (M.S., Department of Natural Resources Ecology & Management, Iowa State University), graduated May 2015
- Julia Dale (M.S., Department of Natural Resources Ecology & Management, Iowa State University)
- Karri Folks (Ph.D., Department of Natural Resources Ecology & Management, Iowa State University)
- Joe Lambert (M.S., Department of Natural Resources Ecology & Management, Iowa State University)
- David Loney (Ph.D., Ecology and Evolutionary Biology, Iowa State University)
- Audrey McCombs (Ph.D., Ecology and Evolutionary Biology, Iowa State University)
- Bridget Nixon (M.S., Department of Natural Resources Ecology & Management, Iowa State University)
- Matt Stephenson (M.S., Department of Natural Resources Ecology & Management, Iowa State University)
- Brenna Towery (M.S., Department of Natural Resource Ecology & Management, Iowa State University), graduated May 2015

Committee Member
- Chris Anderson (M.S., Department of Natural Resource Ecology & Management, Iowa State University), graduating August 2016
- Kelly Boyer (Ph.D. Ecology and Evolutionary Biology, Anthropology, Iowa State University)
- Shubham Datta (Ph.D., Natural Resource Department, South Dakota State University)
- Will Inselman (M.S., Natural Resource Department, South Dakota State University), graduated May 2015
- Morgan Mackert (M.S., Ecology and Evolutionary Biology, Iowa State University)
- Sarah Mitchell (M.S., Ecology and Evolutionary Biology, Iowa State University), graduated December 2015
- Amy Moorhouse (M.S., Department of Natural Resource Ecology & Management, Iowa State University), graduating August 2016
- Zach Ruff (M.S., Department of Natural Resources Ecology & Management, Iowa State University)

Clay Pierce
Advisor/Co-Advisor
- Alex Bybel (M.S., Department of Natural Resources Ecology & Management, Iowa State University)
- Carlos Camacho (M.S., Department of Natural Resources Ecology & Management, Iowa State University)
- Nathan Mills (M.S., Department of Natural Resources Ecology & Management, Iowa State University)
- Christopher Sullivan (M.S., Department of Natural Resources Ecology & Management, Iowa State University)
- Jennifer Swanson (M.S., Department of Natural Resources Ecology & Management, Iowa State University)
- Courtney Zambory (M.S., Department of Natural Resources Ecology & Management, Iowa State University)
Committee Member
- Emily Ball (Ph.D., Department of Natural Resources Ecology & Management, Iowa State University)
- Nick Simpson (M.S., Department of Natural Resources Ecology & Management, Iowa State University)
- Andrea Sylvia (Ph.D., Department of Natural Resources Ecology & Management, Iowa State University)

Professional Service

Jessica Bell (Unit Staff)
- Iowa State University Professional & Scientific Council
  - Councilor, College of Agriculture & Life Sciences Representative, 2013 - present
  - Vice President of University Community Relations, July 2015 – June 2016
  - Elected President – Elect for FY17 – March 2016

Carlos Camacho (M.S. Student)
- Iowa State University Student Subunit of the Iowa Chapter of the American Fisheries Society, Graduate Adviser, 2013- present
- Iowa State University, Natural Resource Ecology and Management, Graduate Student Organization
  - President, 2015 - present
  - Seminar Series Fisheries Chair, 2014 - 2016
  - Field notes (Graduate Student Magazine) Editor, 2014 - 2016
- American Fisheries Society
  - National Chapter
  - Iowa Chapter
  - Iowa State University Student Subunit

Robert Klaver
- American Society of Mammalogists, Member, 1996 – present
- Great Plains Natural History Society, Member, 2010 – present
- Iowa Action Plan Implementation Committee, Member, 2012 – present
- The Wildlife Society
  - Member, 1974 - Present
  - Iowa Chapter, Member, 2012 – present
  - North Central Section, Member, 2012 – present

Clay Pierce
- American Fisheries Society
  - Continuing Education Committee, Iowa Chapter, Chair, 1997 – present
  - Iowa Chapter, Member, 1994 - present
- Iowa Wildlife Action Plan, Fish Subcommittee, Iowa DNR, Chair, 2008 - present
- Stream Nutrient Technical Advisory Committee, Iowa Department of Natural Resources, Member (invited), 2010 - present
- Wildlife Working Group, Iowa DNR, Member (invited), 2009 – present

Nicholas Simpson (M.S. Student)
- Iowa State University, Natural Resource Ecology and Management, Graduate Student Organization
  - Officer, Errington Lecture, 2016-Present

Chris Sullivan (M.S. Student)
- Iowa State University, Natural Resource Ecology and Management, Graduate Student Organization
  - President, 2016 - present
  - Seminar Series Chair, 2015 – 2016
  - Brown Bag Chair, 2015 - 2016
- Iowa State University Student Subunit of the Iowa Chapter of the American Fisheries Society, Graduate Adviser, 2014- present