Nebraska Cooperative Fish and Wildlife Research Unit—USGS

REPORT OF ACTIVITIES
October 2008 – October 2009

Cooperating Agencies

Nebraska Game and Parks Commission
The Wildlife Management Institute
University of Nebraska–Lincoln
U.S. Fish and Wildlife Service
U.S. Geological Survey (USGS) – Biological Resources Division

Report of Activities
October 2008 – October 2009

Nebraska Cooperative Fish and Wildlife Research Unit—USGS
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INTRODUCTION

The U.S. Geological Survey (USGS) Cooperative Research Units Program has been in existence for over 70 years as a partnership between USGS, state natural resource agencies, host universities, the Wildlife Management Institute and the U.S. Fish and Wildlife Service. The first unit was located at Iowa State University in Ames, Iowa. The program currently has 39 units in 37 states.

In 1960, the U.S. Congress gave statutory recognition to the program when they enacted Public Law 86-686, the Cooperative Research Units Act. The intent of the act was to "facilitate cooperation between the Federal Government, colleges, and universities, the States, and private organizations for . . . research and education relating to fish and wildlife, and for other purposes [by developing] coordinated, cooperative research and training programs for fish and wildlife resources. . . ."

The three-part mission of the Cooperative Research Units Program is focused on education, research and technical assistance.

- Education. Unit scientists teach graduate-level university courses and provide graduate students academic guidance, linking the research mission with student training.
- Research. Unit scientists conduct research that supports the needs of local cooperators and partners. Research can be of local, regional or national interests.
- Technical Assistance. Units provide technical assistance and training to state and federal natural resource managers, and to other natural resource managers as needed. Cooperators benefit from the expertise of unit scientists, cooperating university faculty, and biologists at state natural resource agencies.

In 2004, the Nebraska Cooperative Fish and Wildlife Research Unit became the newest state Cooperative Research Unit through a Cooperative Agreement signed by the U.S. Geological Survey, the University of Nebraska–Lincoln, the Nebraska Game and Parks Commission, the U.S. Fish and Wildlife Service and the Wildlife Management Institute.

PERSONNEL AND COOPERATORS

UNIT PERSONNEL

UNIT STAFF – U.S. GEOLOGICAL SURVEY, COOPERATIVE RESEARCH UNITS PROGRAM

Craig R. Allen, Unit Leader
Joseph J. Fontaine, Assistant Unit Leader – Wildlife
Kevin L. Pope, Assistant Unit Leader – Fisheries

UNIT STAFF – UNIVERSITY OF NEBRASKA–LINCOLN

Tony Barada, Coordinator: Creel Survey Project
Caryl Cashmere, Staff Assistant
Karie Decker, Coordinator: Nebraska Invasive Species Project
Valerie Egger, Administrative Assistant
Annabel Major, Coordinator: Nebraska Invasive Species Project (2007–2009)

RESEARCH TECHNICIANS

Daniel Dobesh
Matt Gruntorad
Kelly Korth
Lucas Kowalewski
Stephanie Lizano
Cassie Novak
E. Ashley Pella
Arjun Potter
David Rempel
Amy Wolf
Christopher Wood

FEDERAL WORK-STUDY STUDENTS

Ted Ehly

CREEL CLERKS

Randy Fusselman
Ron Grandi
Stuart Grant
Greg Hoffman
Ross Juelfs
Rhonda Lawing
M.D. (Doug) Miller
Jerry Schmitt
Chris Trumler
Toby Welch

UNL UCARE STUDENT

Andrew Furman

STUDENT WORKERS

Eric Frandsen
Anthony Miller
Brent Johnson
Jacob Walker
John Walrath

Graduate Degree Candidates

Ph.D., Fisheries

Jason DeBoer, School of Natural Resources, UNL, January 2009 – present

Dustin Martin, School of Natural Resources, UNL, January 2009 – present

M.S., Fisheries

Carla Knight, School of Natural Resources, UNL, March 2009 – present

Ryan Lueckenhoff, School of Natural Resources, UNL, August 2008 – present

Alexis Maple, School of Natural Resources, UNL, March 2009 – present

Lindsey Richters, School of Natural Resources, UNL, January 2008 – present

Peter Spirk, School of Natural Resources, UNL, January 2009 – present

Ph.D., Wildlife

Aaron Lotz, School of Natural Resources, UNL, January 2005 – present

Kristine Nemec, School of Natural Resources, UNL, August 2006 – present

Chad Smith, School of Natural Resources, UNL, August 2007 – present

M.S., Wildlife

Aaron Alai, School of Natural Resources, UNL, August 2007 – present

Michelle Hellman, School of Natural Resources, UNL, August 2009 – present

Sarah Rehme, School of Natural Resources, UNL ,co-advisor (advisor Larkin Powell) January 2008 – present

Lindsey Reinarz, Biology, University of Nebraska Omaha, co-advisor (advisor L. Wolfenbarger), May 2006 – present

Shana Sundstrom, University of Calgary, Canada, June 2006 – December 2009

Kody Unstad, School of Natural Resources, UNL, May 2009 – present

Amy Williams, School of Natural Resources, UNL, August 2008 – present

Justin Williams, School of Natural Resources, UNL, August 2006 – present

Sam Wilson, School of Natural Resources, UNL, August 2006 – present

Graduates, 2008–09

Fisheries

Dustin Martin, M.S., School of Natural Resources, UNL, December 2008

Wildlife

Thaddeus Miller, M.S., School of Natural Resources, UNL, May 2009

Katherine Weeks, Ph.D., Department of Biological Sciences, Clemson University, August 2009

Tim Davis, Ph.D., Department of Entomology, Clemson University, May 2009

Coordinating Committee Members

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University of Nebraska–Lincoln Faculty

Sherilynn Fritz, Geosciences
Kyle Hoagland, School of Natural Resources
Scott Hygnstrom, School of Natural Resources
Stevan Knezevic, Northeast Research and Extension Center
Gary Lynne, Agricultural Economics
Jim Merchant, School of Natural Resources
Mark Pegg, School of Natural Resources
Larkin Powell, School of Natural Resources
Tom Powers, Department of Plant Pathology
Ashok Samal, Computer Science and Engineering
Dan Snow, Water Center
John Stansbury, Engineering Department
Alan Tomkins, NU Center for Public Policy
Andrew Tyre, School of Natural Resources
Dave Wedin, School of Natural Resources
Sandra Zellmer, Law College

Nebraska Game and Parks Commission

Rex Amack, Director
Jim Douglas, Wildlife Division Administrator
Don Gabelhouse, Jr., Fisheries Division Administrator
Alicia Hardin, Assistant Wildlife Division Administrator
Jeff Hoffman, Wildlife Division
Richard Holland, Assistant Fisheries Division Administrator
Caleb Huber, Fisheries Division
Keith Hurley, Fisheries Division
Jeff Jackson, Fisheries Division
Joel Jorgensen, Wildlife Division
Keith Koupal, Fisheries Division
Kirk Nelson, Assistant Director
Larry Pape, Fisheries Division
Mark Porath, Fisheries Division
Lindsey Richters, Fisheries Division
Steve Riley, Assistant Wildlife Division Administrator
Dean Rosenthal, Assistant Fisheries Division Administrator
Rick Schneider, Natural Heritage Program
Scott Taylor, Assistant Wildlife Division Administrator
Dave Tunink, Assistant Fisheries Division Administrator
Sam Wilson, Wildlife Division
Gene Zuerlein, Assistant Fisheries Division Administrator

Federal Agencies

U.S. Army Corps of Engineers
U.S. EPA–Cincinnati Rainwater Basin Joint Venture
U.S. Fish and Wildlife Service, DeSoto National Wildlife Refuge
U.S. Fish and Wildlife Service, Ecological Services, Nebraska Field Office

U.S. Fish and Wildlife Service, Fort Niobrara–Valentine National Wildlife Refuge
U.S. National Park Service
U.S. National Park Service / Great Plains Cooperative Ecosystems Studies Unit
USDA Animal and Plant Health Inspection Service (APHIS)
USDA Forest Service, Rocky Mountain Research Station
USDA National Resource Conservation Service (NRCS)

State Agencies

Arkansas Game and Fish Commission
Iowa Department of Natural Resources
Kansas Department of Wildlife and Parks
Louisiana Department of Wildlife and Fisheries
Missouri Department of Conservation
Nebraska Department of Agriculture, Noxious Weed Program
Nebraska Forest Service
The Nebraska Environmental Trust
North Dakota Game and Fish Department
Oklahoma Department of Wildlife Conservation
Texas Parks and Wildlife Department

Private Sector Cooperators

Aquatic Consultants, Inc.
In-Fisherman, Inc.
The Nature Conservancy
Turner Foundation

Other Faculty Cooperators

Graeme Cumming, University of Cape Town, South Africa
John Dettmers, Great Lakes Fishery Commission and University of Illinois at Urbana–Champaign
Lance Gunderson, Department of Environmental Studies, Emory University
C. S. Holling, Department of Zoology, University of Florida
Mac Horton, Department of Entomology, Clemson University
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Patrick Jodice, USGS–South Carolina Cooperative Fish and Wildlife Research Unit, Clemson University
Alan Kolok, Department of Biology, University of Nebraska at Omaha
Wayne Landis, Inst. of Environmental Toxicology, Huxley College of the Environment, Western Washington Univ.
Steve Lockmann, Department of Aquaculture and Fisheries, University of Arkansas at Pine Bluff
Pablo Marquet, Departamento de Ecología, Universidad Católica de Chile, Santiago, Chile
John McCarty, Department of Biology, University of Nebraska at Omaha
Garry Peterson, Stockholm University, Sweden
Reynaldo Patiño, USGS–Texas Cooperative Fish and Wildlife Research Unit, Texas Tech University
Jan Sendzimir, International Institute for Applied Systems Analysis, Austria
Richard Strauss, Department of Biology, Texas Tech University
Joan Walker, USDA Forest Service, Clemson University
Gene Wilde, Department of Biology, Texas Tech University
L. LaReesa Wolfenbarger, Department of Biology, University of Nebraska at Omaha

MILESTONES

Creel Survey Project

The Nebraska Game and Parks Commission awarded a large grant to Kevin Pope to study the influence of anglers on fish populations across Nebraska. This grant will support five to seven graduate students, a project coordinator, and eight to ten creel clerks over the next five years. This applied project will support the management mission of the Nebraska Game and Parks Commission by increasing our understanding of patterns of angler participation on local and regional scales, and how angler participation influences fish populations.

Fully Staffed

The Nebraska Unit is now fully staffed. Joseph J. Fontaine became the third federal scientist on January 1, 2009. Staff assistant, Caryl Cashmere, joined the Unit on July 6, 2009.

Grants

Unit scientists secured nearly eight million dollars in external research funds.

National Science Foundation

The University of Nebraska–Lincoln was awarded a National Science Foundation Integrative Graduate Education and Research Traineeship (IGERT) award. This is the first IGERT awarded to Nebraska and will support about 26 Ph.D. traineeships. PI: Craig R. Allen. Co-PIs: Sherilynn Fritz, Ashok Samal, Andrew Tyre, Alan Tomkins.

Students

We currently have nineteen degree candidates advised by Craig Allen and Kevin Pope. This will increase as Joseph Fontaine, who joined the Coop Unit in January, brings on graduate students. Two students earned master's degrees in natural resources from the University of Nebraska–Lincoln: Dustin Martin, fisheries; Thaddeus Miller, wildlife. Dustin is continuing his education in a Ph.D. program at the University of Nebraska–Lincoln. Thad is a scientific writer for Li-Cor in Lincoln, Nebraska.

Workshop

Scientists with the Nebraska Coop Unit are coordinating the Adaptive Management Symposium for the 70th Midwest Fish and Wildlife Conference that will be held in Springfield, Illinois, December 6 – 9, 2009.

AWARDS AND RECOGNITIONS

Othmer Fellowship

Jason DeBoer received the University of Nebraska–Lincoln Othmer Fellowship. He was awarded this prestigious award in addition to a departmental assistantship.

Other Grants and Awards

Dustin Martin received a Center for Great Plains Studies Research Grant-in-Aid award ($280) to assist with postage expenses for a mail survey.

Kristine Nemec received a J.E. Weaver Competitive Grant ($1,000) from The Nature Conservancy to assist with insect identification expenses.

Sarah Rehme was awarded a J.E. Weaver Competitive Grant by The Nature Conservancy ($1,000), and also a Center for Great Plains Studies Graduate Student Research Grant-in-Aid award ($550). The grants are funding DNA analyses of samples taken from chicks of target species.

Amy Williams received a Center for Great Plains Studies Research Grant-in-Aid award ($400) to help off-set research expenses.

THESES AND DISERTATIONS

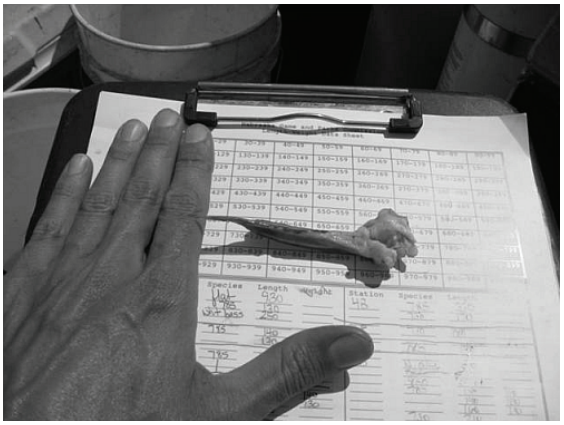
Dustin Martin. MS. 2008

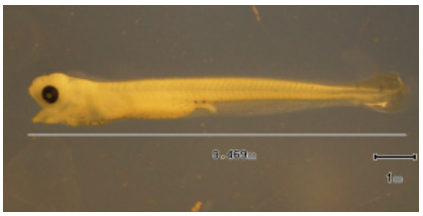
Habitat Selection by Spawning Walleye and White Bass in Irrigation Reservoirs of the Republican River Basin, Nebraska
Advisor, Kevin Pope

Thaddeus Miller. MS. 2009

Risk Assessment: An Approach to Prioritizing the Control of Invasive Plant Species and the Conservation of Rare Species and Plant Communities
Advisor, Craig Allen

PROJECTS IN FISHERY SCIENCE





Angler Behavior in Response to Management Actions on Nebraska Reservoirs

Principal Investigator:	Kevin L. Pope
Project Coordinator:	Tony Barada
Graduate Student(s):	Dustin Martin, Ph.D.; Carla Knight, M.S; Alexis Maple, M.S.; Peter Spirk, M.S.
Project Duration:	January 2009 – December 2013
Funding:	Nebraska Game and Parks Commission
Project Location:	Statewide Nebraska

Natural resource agencies invest substantial resources to recruit anglers—the Nebraska Game and Parks Commission is no different. However, there is little understanding of human motives for participating in angling activities. Even less is known about the effects of management actions on angler participation.

Project goals are to understand 1) the participation patterns of anglers on local and regional scales, and 2) how participation patterns of anglers influence fish populations.

The project currently has three study components:

1. *Statewide Angler Survey*: Creel surveys are being conducted on Calamus Reservoir, Harlan County Reservoir, Lake McConaughy, Lewis and Clark Lake, Merritt Reservoir, and Sherman Reservoir April through October 2009–2013. These surveys provide continuation to long-term (>10–20 years) data sets that are valuable for assessment of temporal changes in angler participation. In particular, these extended data sets will allow for relational assessments of changes in angling participation with environmental conditions and management actions on large-scales.

2. *Regional Angler Survey*: An intensive year-round survey being conducted on 19 reservoirs in the Salt Valley region of SE Nebraska. This survey will provide the baseline data necessary to develop a model predicting temporal and spatial participation of anglers. This model will be especially useful for understanding changes in fishing pressure on specific reservoirs as influenced by conditions at near-by reservoirs such as water drawdowns for repairs to in-reservoir structures, out-breaks of blue-green algae, etc.

3. *Angler Effects on Sexually-Dimorphic Fish Species:* Detailed information (species, length, weight, age, sex, liver weight, and gonad weight) is being gathered on fish harvested at Sherman and Calamus reservoirs during spring 2009 and 2010. Differences in harvest among male and female fish can alter sex-specific rates of recruitment, growth, and mortality, and hence, the overall health of a fish population. Species included in this assessment are channel catfish, walleye, and crappie.

Geographic Trends in Contamination of Nebraska's Surface Waters as Indexed by Sex Steroids of Common Carp

Principal Investigator:	Kevin L. Pope, Alan S. Kolok and Dan D. Snow
Graduate Student(s):	none
Project Duration:	March 2008 – March 2009
Funding:	U.S. Geological Survey 104b (funds administered by UNL Water Center)
Project Location:	Statewide Nebraska

During the past few years, endocrine disrupting compounds (EDCs) have been identified in Nebraska streams and rivers, particularly downstream from beef cattle feedlots and from local wastewater treatment plants. Evaluating the extent to which EDCs occur in these streams—and in lakes and reservoirs throughout Nebraska—is important because recruitment of fishes in these water bodies is extremely variable, and EDCs are sometimes suggested as responsible for the limited recruitment.

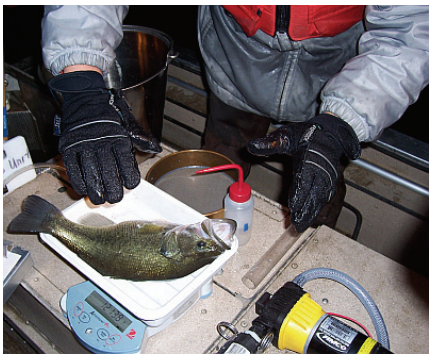
The specific objectives of this project were to document occurrence and concentrations of steroidogenic contaminants in water from water bodies throughout Nebraska and examine geographic variation in effects of sex steroids on adult common carp. We used common carp sex steroids and carp gene expression profiles as indirect indicators of exposure to EDCs, and water samples from each reservoir were used to provide a "snapshot" of EDCs concentration. We hypothesized that sex steroid profiles would vary considerably across the state, and would be associated with bioavailability of steroidogenic compounds within each reservoir. Contrary to our *a priori* expectations, we did not find a geographic trend in the occurrence of steriodogenic compounds. Further, endpoints from the two measures we used to assess biological effects of EDCs in water bodies across Nebraska (plasma sex steroid concentrations and hepatic vtg mRNA expression) did not agree. Thus, further research is needed to assess geographic variation in sex steroids within aquatic systems.

Impact of White Perch on Walleye at Branched Oak and Pawnee Reservoirs

Principal Investigator:	Kevin L. Pope
Graduate Student(s):	Nathan Gosch, M.S. (2008)
Project Duration:	January 2006 – December 2008
Funding:	U.S. Geological Survey (RWO 4)
Project Location:	Branched Oak Lake (Lancaster County) and Pawnee Lake (Lancaster County), Nebraska

Habitat alterations and accidental introduction of white perch into Branched Oak Lake have shifted the fish community from one dominated by littoral (near-shore) species (e.g., largemouth bass and bluegill) to one dominated by pelagic (open-water) species (e.g., white perch and gizzard shad). Along with the change in the fish community, angler trips to Branched Oak Reservoir have declined by 85% over the last two decades. Further, the white perch population has become stunted (high density of slow growing individuals that mature at a small size). Like Branched Oak Lake, Pawnee Lake historically supported an active and diverse fishery, and has experienced similar habitat alterations and accidental introduction of white perch. However, unlike Branched Oak Lake, stunting has not yet occurred in the white perch population in Pawnee Lake. This provided an opportunity to examine white perch interactions with other fishes in two similar Nebraska water bodies at different white perch population stages (i.e., stunted and non-stunted). This project helped document potential competition bottlenecks that exist between white perch and other fish species of importance in the hopes of developing a management program to eliminate the stunted status for the white perch population in Branched Oak Lake and to prevent stunting of the white perch population in Pawnee Lake.

Primary research finding: Food habits of white perch were similar among the two populations, suggesting that changes in population status (e.g., shifting a population from a stunted state to a non-stunted state) would not change the food consumed by white perch.



LATITUDINAL INFLUENCE ON AGE ESTIMATION OF BLUEGILL

Principal Investigator:	Kevin L. Pope
Undergraduate Student:	Andrew Furman
Project Duration:	October 2007 – December 2008
Funding:	University of Nebraska–Lincoln Undergraduate Creative Activities and Research Experiences (UCARE) Program*
Project Location:	Arkansas, Kansas, Louisiana, Missouri, Nebraska, North Dakota, Oklahoma, and Texas

This project compared age estimates of bluegill as determined from two common structures—scales and otoliths (inner ear bones)—across a large latitudinal gradient. Scales can be collected from fish without harming them. Otoliths can only be collected from sacrificed fish. Age estimates from otoliths are assumed to be uninfluenced by latitude range encompassing the USA. In contrast, little is known about the relationship between latitude and age estimates from scales—accuracy of age estimates could increase linearly for fish as one moves from north to south, or accuracy of age estimates may be constant (unaffected by latitude) on both sides of a threshold.

The goal of this project was to determine the latitudinal relationship, from North Dakota to Louisiana, for age estimates of bluegill determined from scales. Initial findings provide no evidence that latitude influences accuracy of ages estimated for bluegill with scales, assuming that ages estimated were accurate with otoliths. Thus, no apparent threshold exists along the latitudinal gradient of the continental USA for which scales are as equally reliable as otoliths for accurately estimating ages of bluegill. Laboratory assessments are on-going.

**The University of Nebraska–Lincoln UCARE Program is sponsored by the Pepsi Endowment, created by contract between the University and the Pepsi-Cola Company, and Program of Excellence funds. UCARE supports UNL undergraduate students to do research or creative activities with UNL faculty members.*

Predators of White Perch at Branched Oak and Pawnee Reservoirs

Principal Investigator:	Kevin L. Pope
Graduate Student(s):	Nathan Gosch, M.S. (2008)
Project Duration:	January 2006 – December 2008
Funding:	Nebraska Game and Parks Commission
Project Location:	Branched Oak Lake (Lancaster County) and Pawnee Lake (Lancaster County), Nebraska

Sedimentation and erosion have significantly altered the habitat of Branched Oak Lake, resulting in loss of usable littoral habitat and a predominance of turbid open-water areas. This loss of critical near-shore habitat, coupled with the introduction of the white perch, has changed the population dynamics within the fish community. White perch numbers have increased precipitously over the last decade resulting in a stunted white perch population in Branched Oak Lake. This unchecked white perch population is suspected of severely limiting recruitment of sport fishes such as walleye. Control of this stunted white perch population is thus desired. Chemical renovation of Branched Oak Lake has been considered; however, logistical difficulties have precluded this action. Research was initiated to assess the feasibility of biological control of white perch via predation.

The purpose of this project was to quantify food habits of adult white crappie, walleye, channel catfish, flathead catfish, hybrid striped bass and white bass to determine which, if any, of these fishes prey on white perch. Like Branched Oak Lake, Pawnee Lake historically supported an active and diverse fishery, and has experienced similar habitat alterations and accidental introduction of white perch. However, unlike Branched Oak Lake, the Pawnee Lake white perch population has not yet stunted. Thus, an opportunity existed to document predators of white perch in populations with two different size structures, allowing for predictions of likely changes in food habits of predators with purposeful changes in the targeted prey (white perch) population. This project provided information about food habits of predatory fishes that could allow for refinement of the current management program for white perch populations in Nebraska reservoirs.

Primary research finding: The current predatory population in Branched Oak Lake is unlikely to alter (via predation) the stunted status of the white perch population. Rather, the cropping off of larger white perch via predation in Branched Oak Lake is reinforcing the stunted status of the white perch population.

Population Assessment of Channel Catfish in Nebraska

Principal Investigator:	Kevin L. Pope
Graduate Student(s):	Lindsey Richters, M.S.
Project Duration:	January 2008 – December 2010
Funding:	Nebraska Game and Parks Commission
Project Location:	Statewide Nebraska

Channel catfish is an increasingly sought after sport fish, particularly in the Midwest. Despite the national and local popularity of channel catfish as a sport fish, little is known of its population dynamics or habitat requirements, and assessment of management strategies is lacking. The Nebraska Game and Parks Commission (NGPC) currently utilizes experimental gill nets set in autumn as the standard sampling methodology for channel catfish. This protocol typically provides small sample sizes that are inadequate for the assessment of population dynamics (recruitment, growth and mortality) and structure (abundance, size structure, and condition). The NGPC is considering a shift to a new sampling gear (tandem, baited hoop-nets) that will increase the odds of collecting samples large enough to assess population dynamics and structure, thereby creating a stronger foundation for management decisions.

This project is focused on assessing the present variability in the dynamics (recruitment, growth and mortality) and structure (abundance, size- and age-structure, and condition) of channel catfish populations found in standing water bodies throughout Nebraska. Catfish populations from across Nebraska will be compared among water-body types and among stocking strategies. Information gained will help managers determine the need for future stockings and harvest regulations of channel catfish. Further, catches of catfish in tandem, baited hoop-nets will be compared with catches of catfish in experimental gill nets; this comparison will aid NGPC in their deliberations with regard to a potential change in sampling standards for channel catfish in standing water bodies.

Approximately 5,200 catfish were collected from 22 Nebraska water bodies during the first sampling season (summer 2008); ages were estimated for approximately 2,400 of those catfish. An additional 20 water bodies were sampled during the second and final sampling season (summer 2009); fish samples are currently being processed. The 2009 sampling season also included return visits to three water bodies sampled during the first season to document temporal variability in catch rates.

Recruitment of Walleye and White Bass in Irrigation Reservoirs

Principal Investigator: Kevin L. Pope

Graduate Student(s): Jason DeBoer, Ph.D.
Christopher Lewis, Ph.D.
Dustin Martin, M.S. (2008)
Ryan Lueckenhoff, M.S.

Project Duration: September 2006 – August 2011

Funding: Nebraska Game and Parks Commission

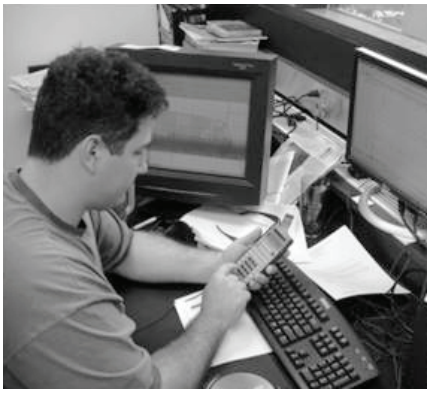
Project Location: Enders Reservoir, Medicine Creek Reservoir, Red Willow Reservoir, and Swanson Reservoir, Nebraska

The five reservoirs within Nebraska's Republican River watershed (Swanson, Enders, Red Willow [also referred to as Hugh Butler], Medicine Creek [Harry D. Strunk], and Harlan County) were built primarily for flood control and irrigation, resulting in large in-reservoir water-level fluctuations within and among years. These reservoirs also provide important fisheries for anglers in southwest Nebraska; walleye and white bass are of particular importance in these reservoirs. However, continued annual stockings of walleye are necessary because natural production is limited. In contrast, white bass populations are self-sustaining within these reservoirs, although recruitment is extremely erratic (i.e., weak or missing year-classes are common) in all but Harlan County Reservoir. A "recruitment bottleneck" likely exists for walleye and perhaps white bass in these irrigation reservoirs. The purpose of this project is to gain an understanding of the factors affecting recruitment of walleye and white bass in irrigation reservoirs. The primary foci are documenting the relative importance of spawning habitats and determining when the suspected recruitment bottleneck for walleye and white bass occurs in southwest Nebraska irrigation reservoirs. This information is vital for understanding reservoir fish ecology in semiarid regions.

Dustin Martin completed his thesis research assessing the relative importance of spawning habitats for walleye and white bass. Spawning habitat selection by adult walleye and white bass was studied at Enders and Red Willow reservoirs using acoustic telemetry and electrofishing. Adult walleye selected sites with cooler water temperatures and greater fetch at Enders Reservoir, and sites with large rock substrate and no cover at Red Willow Reservoir. These sites were limited to the area on or near the riprap dam at both reservoirs. Walleye egg abundance was also greatest in these areas. However, abundances of larval walleye were not greatest in these areas; habitat selection by larval walleye was driven by the absence of cover and fetch. Habitat selection by adult white bass was undetected—white bass were distributed throughout both reservoirs during the spawning period.

Sampling walleye and white bass populations continues in these reservoirs. Several more years of data are needed to begin initial explorations for potential recruitment bottlenecks of walleye and white bass in southwest Nebraska irrigation reservoirs. Difficulty distinguishing juvenile hybrid striped bass from juvenile white bass added an unexpected dimension to this project. Thus, genetic assessments were initiated on age-0 and age-1 temperate basses this past year.

PROJECTS IN WILDLIFE SCIENCE



Assessing the Relationship between Stable Isotopes and Grassland Bird Productivity on Great Plains National Park Service Properties

Principal Investigators:	Larkin Powell and Craig R. Allen
Graduate Student(s):	Sarah Rehme, M.S.
Project Duration:	June 1, 2007 – September 30, 2010
Funding:	U.S. Geological Survey Natural Resource Preservation Program (NRPP), and The National Parks Service (RWO 2)
Project Location:	Three National Park Service Units in Kansas, Minnesota, Nebraska

National Park Service (NPS) units in the Great Plains are a source of breeding habitats for many grassland birds. But the relative value of the NPS grassland habitats to regional songbird production is unknown. To understand if management practices in NPS grasslands are effective for songbird production, or if the size of NPS units is adequate for providing the necessary habitat, nest survival needs to be documented—a prohibitively labor-intensive and expensive process when conducted on a regional scale. Park managers need lower-cost data for informed decision-making.

The project will use unique methods—stable isotope analyses of avian tissues—to evaluate variability in productivity and fidelity of grassland birds at three NPS units in the Great Plains: Homestead National Monument, Nebraska; Pipestone National Monument, Minnesota; and Tallgrass Prairie National Preserve, Kansas. Stable isotope analyses may allow biologists to efficiently gauge the importance of grassland habitat patches to regional productivity. In forested habitats, analyses of the variability in isotope values inferred that second-year ovenbirds (*Seiurus aurocapillus*) had lower fidelity to a study area than older individuals. This project will evaluate whether stable isotope analyses can be extended to breeding grassland birds and will target four species of grassland birds, dickcissel (*Spiza americana*), grasshopper sparrow (*Ammodramus savannarum*), eastern meadowlark (*Sturnella magna*), and western meadowlark (*Sturnella neglecta*), which are common in the study parks. Upon completion, NPS managers will receive a habitat-quality assessment for breeding grassland birds at the three study areas, as well as our assessment of stable isotope techniques.

The first year of field research (2008) found avian nest survival for Homestead and Tallgrass to be about 40% for target species. Low numbers of nests for all parks made 2008 results tentative. Homestead had estimates of 44.9 dickcissels and 0.8 eastern meadowlarks. No target species nests were found in Pipestone. Pipestone had estimates of 0.9 dickcissels and 3.9 western meadowlarks for the entire park. Tallgrass estimates were 5,067 dickcissels, 3,048 eastern meadowlarks, and 4,588 grasshopper sparrows for the western portion of the park.

Six technicians have completed collecting 2009 data at all three parks. Analysis of stable isotope values from feather and blood samples taken from nestlings and adults have yet to be completed. DNA analysis will determine the sex of each chick, and calculate the ratio of male to female chicks in each nest. Results will be used to test the assumption that sex ratios are equal when calculating fecundity estimates.

Climate Change as a Challenge to Bird Conservation in Arid and Semi-arid Regions of North America

Principal Investigator:	Joseph J. Fontaine, Susan K. Skagen (PI), Charles van Riper III
Graduate Student(s):	Jherime Kellermann, Ph.D. (University of Arizona)
Project Duration:	November 1, 2007 – September 30, 2009
Funding:	U.S. Geological Survey National Climate Change and Wildlife Science Center; T & E, Inc
Project Location:	Colorado, Rio Grande, San Pedro, and Santa Cruz River Valleys; Arizona, New Mexico

Global climate change has dramatically altered seasonal climate conditions, but while sedentary communities have responded by advancing phenology, shifts in the phenology of migratory species are often less than expected. The limited response of migrants suggests there are significant constraints restricting the ability of these populations to respond to changing climates. The goal of this project is to determine the relative sensitivities of migrating songbirds to climate change per se as well as the loss of riparian forests the depend upon during migration due to the synergetic interaction of climate change and changing water use patterns. For the last year we have been exploring the potential impacts of recent climate patterns on migratory birds by merging existing climate and water data with data from 30+ collaborators studying avian migration along the four river systems in the desert southwest (Rio Grande, San Pedro, Santa Cruz, and Colorado rivers). This has yielded a single database that includes information on the timing of migration, avian diversity and abundance, measures of climate, water availability, and elevation. Based on this data we are currently developing a series of models to describe the major climatic factors influencing migration patterns along the four major river drainages.

We have also developed a series of theoretical models examining spatial and temporal variation in climate change from the perspective of migratory birds. We reconstructed over 50 years of climate data from across western North America to show that not only are migratory birds experiencing climate change, but the relative rates of climate change differ considerably between migratory and breeding locations. This has resulted in birds now experiencing relatively wetter breeding locations and warmer spring migration locations due to global climate change. Moreover, there is considerable variation in the relative discordance in climate change between breeding and migratory locations based on the timing and distance of migration which ultimately predicts the sensitivity of migratory bird populations to ongoing climate change. Based on these findings we are currently exploring aspects of phenotypic plasticity which may enable migrant birds to track localized changes in resources and alter migration patterns in response to changing climate. In doing so we have begun to evaluate flexibility in habitat use by migrants by examining the timing, distribution, and abundance of migratory birds across an elevational gradient of distinct habitats types throughout southeast Arizona.

Cross–Scale Structure and Scale Breaks in Complex Systems

Principal Investigator:	Craig R. Allen
Graduate Student(s):	Aaron Lotz, Ph.D. Donald Wardwell, M.S. (2006) Aaron Alai, M.S.
Project Duration:	July 1, 2004 – December 2008
Funding:	James S. McDonnell Foundation
Project Location:	University of Nebraska–Lincoln, Clemson University

This research was motivated by the discovery of regular patterns of deviation from scaling laws and the continuous distributions of attributes of complex systems. This suggests that systems organize over discrete ranges of scale, and that organization abruptly shifts with changes in scale. If this is so, scaling laws serve only as the baseline from which to measure those departures, and those departures indicate "scale breaks" (transitions) between scales of structure in complex systems. Patterns of scale breaks from a scaling law baseline may provide clues to the processes that lead to the emergence of the scaling relationships themselves. At the minimum, investigating departures from scaling laws give us a clue into the nature of the structure and process of the system in question. These investigations also help us understand and perhaps predict phenomena that have puzzled ecologists and other scientists, such as the generation of biological diversity and the emergence of phenomena such as resilience.

Scale breaks in attributes of animal communities (such as body masses) correlate strongly with a set of poorly understood biological phenomena that seem to mix contrasting attributes. These phenomena include invasion, extinction (high species turnover), increased population variability, migration and nomadism. Recently, it has been demonstrated that the body masses of endangered and invasive species in a community occur at the edges of body mass aggregations two to four times as often as expected by chance. That correlation is consistent in all data sets examined so far. Those include four different taxa in two different ecosystems. It may seem surprising that both invasive and declining species are located at the edge of body-mass aggregations. These results suggest that something similar must be shared by the two extreme biological conditions represented by invasive species and declining species. An examination of the phenomena of nomadism in birds in an Australian Mediterranean climate ecosystem found that nomadic birds also cluster about scale breaks (occur at the edge of body mass aggregations). The clustering of these phenomena at predictable scale breaks suggests that variability in resource distribution or availability is greatest at these states. Location at scale breaks affords species great opportunity, but also potential crisis. Complex behaviors such as migration and rapid adaptation leading to speciation may evolve most efficiently and commonly at scale breaks, where there is the greatest potential reward, although with the highest potential cost.

Examining nomadic, migratory, and species in decline within the framework of the Textural Discontinuity Hypothesis has yielded some interesting results. The position in which a species exists within a body mass aggregation can aid in predicting nomadic and migratory bird species. Almost all models tested show that as a species approaches the edges of a body mass aggregation it has a greater likelihood of being nomadic or migratory. Models testing for species decline, however, yield less robust results and instead indicate that larger body masses of species indicate a declining population. However, these results may be due in part to human observation of declining species being biased towards larger species. The actual structure of these aggregations can yield interesting facts about how species interact with each other as well. In analyzing species body mass aggregations as dictated by the Textural Discontinuity Hypothesis, data indicate there is a larger spread of body masses within in aggregations. This means that within aggregations better competitors may arise and occupy larger sections of body mass aggregations.

The Effect of Common Reed on River Otter Habitat Use

Principal Investigator:	Craig R. Allen
Graduate Student(s):	Amy Williams, M.S.
Project Duration:	May 2009 – December 2010
Funding:	Nebraska Game and Parks Commission The Nebraska Environmental Trust
Project Location:	Big Bend Region of the Platte River

The recent invasion of *Phragmites australis* (common reed) in the Big Bend region of the Platte River has made the need to examine its potential effects on river otters more critical. The ability of *P. australis* to rapidly alter the landscape could have large affects on a population that may still be vulnerable, such as river otters.

Using locations from radio tagged river otters (*Lontra canadensis*) along the central Platte River in conjunction with GIS, this study will determine if otters use river ways with *P. australis*, or if otter den use in areas with *P. australis* is more or less than expected relative to availability, and will identify any differences in otter use of areas before and after *P. australis* treatments. This study will increase our understanding of the effects of this invasive plant on river otters—a flagship species for non-game conservation.

Three trapping seasons have been completed with a total of 18 otters successfully implanted with transmitters. Over 1000 locations have been recorded. The fourth and final trapping season will be conducted this fall in the Central City area of the Platte River.

Identifying Socio-Ecological Factors Determining Invasions and Extinctions

Principal Investigators: Craig R. Allen

Graduate Student(s): Aaron Lotz

Project Duration: 2009

Funding:

Project Location:

The proportion of endangered and invasive species within a country can be used as a measure of a country's ecosystem resilience. Countries with a high proportion of endangered and invasive species would be considered less resilient than those countries with low proportions of endangered and invasive species.

Goals are to:

1) Identify and compare key socio-ecological landscape factors between countries with high proportions of invasive and endangered species to those with very few.
2) Examine nationally recognized environmental indexes and their effectiveness in predicting proportions of invasive and endangered species.

Initial conclusions: The proportion of **endangered birds** in a country is positively correlated to the total biodiversity of all species within a country and a country's total land area. The proportion of **endangered mammals** is related to a combination of ecological factors. The proportion of **invasive birds** in a country is positively correlated to the Gross Domestic Product per capita (GDPpc) of a country. The proportion of **invasive mammals** in a country is positively correlated to the GDPpc of a country. When we look at **all the endangered and invasive species** (both birds and mammals) combined, as a measure of resilience, the proportion of endangered/invasive species in a country is positively correlated with human life expectancy. Nationally recognized environmental indexes were not good predictors of the proportion of endangered/invasive species in a country.

Missouri River Mitigation: Implementation and Adaptive Management for Wetland Restoration Evaluation

Principal Investigator: Craig R. Allen

Graduate Student(s): Michelle Hellman, M.S.

Project Duration: July 1, 2009 – March 2014

Funding: U.S. Geological Survey (RWO 11)
U.S. Army Corps of Engineers

Project Location: Missouri River Corridor of Iowa, Kansas, Missouri and Nebraska

This recently funded project will gather the data needed to determine what constitutes a successful wetland restoration, given the desired goals of the U.S. Army Corps of Engineers. Herpetofauna—primarily amphibians—will be used as indicators of wetland quality. This will be accomplished by quantifying the occurrence and recruitment of amphibians at existing mitigation sites and formulating models of quality wetland restorations. These models will be used by managers in future restorations and for adaptive management approaches to the design of new wetland restorations. The study area is the Missouri River corridor of Iowa, Kansas, Missouri and Nebraska.

We are in the initial phase of implementing a monitoring program that will focus on tightly linking monitoring with hypothesis testing in an adaptive framework. The design consists of frog call surveys to determine occupancy rates for a large number of wetlands on numerous restoration properties, coupled with intensive sampling of frogs, turtles and salamanders to assess abundance and recruitment on eight restored wetland complexes in four states. The Nebraska Coop Unit is focusing on wetland complexes in the Falls City to Omaha, Nebraska reach of the Missouri River.

MONITORING, MAPPING AND RISK ASSESSMENT FOR NON-INDIGENOUS INVASIVE SPECIES IN NEBRASKA

Principal Investigator:	Craig R. Allen, Jim Merchant
Program Coordinators:	Karie Decker, Annabel Major
Graduate Student(s):	Aaron Alai, M.S. Amy Williams, M.S. Justin Williams, M.S.
Project Duration:	May 4, 2006 – December 31, 2009
Funding:	Nebraska Environmental Trust
Project Location:	Statewide, Nebraska

Biological invasions are a growing threat to both human enterprise and ecological systems. This project provides resources to the public and private sector on 1) the potential spread and impact of non-indigenous species in Nebraska, 2) actual and potential maps of non-indigenous species range (habitat specific maps at high resolution), 3) information regarding identification and management of potential invaders, 4) centralized information on management and impacts and potential spread of currently established non-indigenous species (a Web portal), 5) outreach within Nebraska to county-level governments and individual stakeholders regarding the management, surveillance and control of non-indigenous species, and 6) an organizational and informational Nebraska conference on non-indigenous species impacts—their spread and management—focusing on state-of-our-knowledge, and coordination of disparate management and information-provisioning efforts with a goal towards unifying disparate efforts.

A Web site was developed, http://calmit.unl.edu/invasives/, which is serving as a centralized clearinghouse on identification, management, impact and potential spread of currently and potentially established non-indigenous species. An invasive species conference was hosted February 6 – 8, 2008 in Lincoln, Nebraska and was attended by over 150 people from around Nebraska and elsewhere.

Research is determining the invasion and distribution potential of non-native plant species in Nebraska. Existing data from scientific collections, agency reports, and solicited expert opinion have been combined to rank the risk of potentially invasive species. Using the I-Rank risk assessment framework, a qualitative species assessment is being developed to rank invasion threat or impact of non-native species. Second, a subset of species was selected to predict their potential geographic range in Nebraska. Classification trees will be used to model the species' potential range using species occurrence data and environmental predictive variables. Together, these two research components will yield information about which species pose the greatest invasion risk and where in Nebraska they are likely to occur.

Annabel Major worked with various agencies and Nebraska state senators to submit legislation that would establish a Nebraska Invasive Species Council, LB 582. In July, Karie Decker assumed the role of project coordinator following Annabel's resignation. Karie will continue working with agencies and Nebraska state senators to establish a Nebraska Invasive Species Council. The council will function as an independent advisory panel on invasive species to promote stronger partnerships in invasive species management, provide research based information to policy makers, and build awareness of these issues throughout the community. Karie will also continue participating in and building outreach programs that promote awareness of invasive species issues.

Grant proposals have been developed and submitted to continue, and further expand, work begun by the project. They will include an aquatic nuisance species plan and an adaptive response plan.

THE RELATIONSHIP BETWEEN DIVERSITY AND ECOLOGICAL FUNCTIONS

Principal Investigator:	Craig R. Allen with Chris Helzer, LaReesa Wolfenbarger
Graduate Student(s):	Kristine Nemec, Ph.D. Lindsey Reinarz, M.S. (University of Nebraska Omaha)
Project Duration:	July 1, 2005 – June 30, 2010
Funding:	James S. McDonnell Foundation Nebraska Game and Parks Commission The Nature Conservancy
Project Location:	Central Platte River Valley, Nebraska

Because restoration of grasslands is an important on-going management activity on many public lands in Nebraska, we are investigating the relationship between species diversity in prairie restorations, and ecological functions at relatively large spatial and temporal scales utilizing restorations along the Platte River in south central Nebraska. The relationship between restoration diversity and ecological functions (e.g., pollination, soil development, resistance to invasion and herbivore control) remains poorly understood. Invasion by aggressive plant species, erosion of diversity over time, and failure to withstand drought or other disturbances are all possible results of unsuccessful restorations. This project seeks to understand how grassland plant diversity affects the provision of ecological services.

We have identified existing high diversity restorations and low diversity remnant grasslands (pastures) as large scale study sites (~100 acre). We also established twenty-four 0.75-acre plots which are planted to six replicates each of four treatments: high diversity sites of ~100 species, high diversity sites at twice the normal seeding rates (to be similar with NRCS practices), and CP25 sites (15 species) at normal and half-normal seeding rates. These sites are currently being used to assess invasion resistance among the treatments, and to assess soil development and nematode populations.

Large scale sites are being used to investigate differences in herbivory, and 2006 data indicate that herbivory rates are lower on high diversity sites. Initial results from 2006 data from smaller plots show lower abundances of bull thistle and sweet clover in high diversity plots compared to low diversity plots. Populations of economically-significant grasshoppers and predatory invertebrates were sampled from June through August 2007. Data collections for soil development, nematodes, and invasion resistance were started in 2006 and repeated in 2007. All spider specimens and most ground beetle specimens from the previous two seasons have been identified. Insect specimens from 2008 sampling have been sorted and sent to insect taxonomists for identification. 2008 – 2009 data collections are complete and include ground beetles, ants, spiders, and aboveground insects such as lady beetles and grasshoppers. Plant species observed along transects were also recorded. Data analysis is ongoing.

River Otter Home Range and Habitat Use

Principal Investigator: Craig R. Allen

Graduate Student(s): Sam Wilson, M.S.
Amy Williams, M.S.

Project Duration: May 1, 2006 – December 31, 2009

Funding: Nebraska Game and Parks Commission

Project Location: Platte River, Nebraska

River otters became reestablished in Nebraska following their reintroduction in the mid 1980s and early 1990s. The species is currently listed as threatened in Nebraska (S2). Despite the high profile of the reintroduction and the otters' role as a flagship species, relatively little is known about river otter ecology in Nebraska. The Nebraska Cooperative Fish and Wildlife Research Unit with the Nebraska Game and Parks Commission (NGPC) initiated this project in October 2006 with the objective of collecting home range and habitat use information on river otters along the big bend area of the Platte River using remote sensing (radio telemetry). We captured and radio-tagged eighteen northern river otters on and near the Platte River, a core component of the specie's distribution in Nebraska.

This project is collecting home range and habitat use information on river otters along the big bend area of the Platte River using radio telemetry. Data collected, in conjunction with the results of an ongoing river otter health and reproductive survey and results from the Nebraska Game and Parks Commission's annual otter bridge survey, will help close existing information gaps and contribute to the creation of the Nebraska River Otter Management Plan and the Statewide Comprehensive Conservation Plan. This is one of the largest otter tracking projects in the United States and the only current project in the Midwest.

SOUTHEAST PRAIRIES BUL AND SANDSTONE PRAIRIES BUL RESEARCH

Principal Investigator:	Craig R. Allen
Other Cooperators:	Chris Helzer (TNC), Jarren Kuipers (NPLT), and Gerry Steinauer (NGPC)
Graduate Student(s):	Kody Unstad
Project Duration:	June 2008 – August 2011
Funding:	Nebraska Game and Parks Commission
Project Location:	Southeast Nebraska

The Southeast Nebraska Flagship Initiative is a collaborative partnership aimed at the conservation of biological diversity and at-risk species in four priority areas in the southeast corner of the state. The partnership was formed through the Nebraska Natural Legacy Program and includes The Nature Conservancy, Northern Prairies Land Trust, Spring Creek Prairie Audubon Center and the Nebraska Game and Parks Commission. Within the partnership there are focus groups for outreach, private lands habitat work, and research/evaluation; each incorporate other partner organizations. The research and evaluation focus group currently includes faculty from the University of Nebraska–Lincoln and University of Nebraska Omaha, as well as scientists from the Nebraska Cooperative Fish and Wildlife Research Unit, Nebraska Game and Parks Commission, The Nature Conservancy and Northern Prairies Land Trust.

The implementation of Flagship Initiatives—including that in the Southeast Prairies Biologically Unique Landscape (BUL)—follows from the Nebraska Legacy Plan which implements a proactive approach to conserving non-game wildlife and biological diversity in an adaptive management framework. The implementation of adaptive management, here defined as conducting management experiments that place competing hypotheses at risk and reduce identified sources of uncertainty while managing trust landscapes, is simplified because the SE Prairie BUL Flagship is a partnership between managers, practitioners and academicians who share the common goal of improving prairie management. The overall goal is to manage prairies (via size of parcels enrolled in conservation measures, spatial aspects of location of particular parcels and groups of parcels) in the SE Flagship Biologically Unique Landscape in the most cost effective and efficient manner while maintaining critical plant-insect relationships (e.g., parasitoids, pollinators) indicative of system fluctuation. We are uniquely situated to initiate this program because we have flagship funding in place, the research steering committee represents the important stakeholders, and the Legacy Plan suggests an adaptive management approach. This is the opportunity to demonstrate one such approach.

The research and evaluation focus group, including the Nebraska Coop Unit, is working toward two major objectives, both aimed at conservation of at-risk species and biological diversity.

1. Evaluate private-lands habitat work that has been occurring for a number of years in order to improve the location, conservation goals, and methods of those projects.
2. Evaluate the current and potential viability of ecological systems within the priority landscapes, especially related to degree of habitat fragmentation in those landscapes. This second objective is designed to inform the first. By understanding the population viability for various taxa and how that status differs between more and less fragmented areas, as well as other variables such as plant diversity, we will be able to more wisely choose both the location and strategies management and conservation projects.

Preliminary data collections were completed in summer 2008. Floristic Quality Assessment data were collected on 16 research sites. Following this, insect sweep netting took place on the same sites. 2009 data collections are complete.

Spatial Risk Assessment of Invasive Species Impacts on Native Species in Nebraska

Principal Investigators:	Craig R. Allen, Jim Merchant
Graduate Student(s):	Thad Miller, M.S. (2009)
Project Duration:	August 31, 2005 – December 31, 2008
Funding:	Nebraska Game and Parks Commission U. S. Geological Survey (RWO 5)
Project Location:	Statewide, Nebraska

This project conducted spatially-based risk analyses for species and communities identified as at-risk. The project focused on assessing the potential risk to native Nebraska species from invasive non-native species. It also conducted community-level risk assessments to evaluate the risk faced by those communities identified as "at-risk" by the Nebraska Game and Parks Commission Legacy Project. Modeling of both stressors and targets was based on species-habitat associations with the use of relevant auxiliary data, as per Gap Analysis protocols. Several different GIS land covers are available for the State of Nebraska and we made use of several of them, as all have different strengths and weaknesses. Where possible, we utilized the methods described in Allen et al. (2001) to incorporate minimum viable population modeling based on minimum critical areas for vertebrate models. Products include spatial models of stressors and targets, models of spatial overlap, hazard indices, and relative risk indices for each target. Stressors (invasive species on the Nebraska Watch List) and targets have been identified.

Where possible, the project incorporated the methodologies and terminology of a regional risk assessment using the relative risks model. Nebraska invasive species were selected from the Nebraska Weed Control Association watch list. The nine species selected were evaluated by the NatureServe invasive species ranking system and given an I-rank of "High." The rare and endangered species selected were from the Nebraska Natural Legacy Project "Tier I" list and have a state rank of 1 or 2 and a global rank of 1, 2, or 3. This resulted in a list of nine rare and endangered species. A manuscript is being developed and should be complete this winter.

Potential habitat for eight invasive plant species was modeled. This was combined with an assessment of the ecological impacts of each invasive species in a regional risk assessment framework to calculate relative risk scores and uncertainty. Results indicate that *Rhamnus cathartica* and *Elaeagnus angustifolia* currently pose the greatest risks to endangered plants, whereas *Elaeagnus umbellata* may pose the highest risk in the future. E. *angustifolia* currently presents the greatest risk to rare communities in the present and forecast scenarios. *Panax quinquefolius* and wet-mesic tallgrass prairies are at greatest risk from invasive species, currently and in the future.

The project is complete. The master's student graduated in May 2009. Thesis title: *Risk Assessment: An Approach to Prioritizing the Control of Invasive Plant Species and the Conservation of Rare Species and Plant Communities*.

UNDERSTANDING INVASIONS AND EXTINCTIONS

Principal Investigator: Craig R. Allen

Graduate Student(s): Aaron Lotz, Ph.D.

Project Duration: August 31, 2005 – December 31, 2008

Funding: U.S. Geological Survey (RWO 3)

Project Location: Lincoln, Nebraska

Mediterranean-climate regions support large human populations resulting in extensive and, outside the Mediterranean Basin proper, rapid, anthropogenic transformation. Compared to other continental areas, Mediterranean regions have been invaded by a large number of non-indigenous organisms, including vertebrates. Concomitant with invasions, declines and extinctions have transformed the faunas of Mediterranean ecoregions. This empirical analysis of global Mediterranean-climate ecosystems 1) compared the vertebrate body mass structures of Mediterranean-climate ecosystems, and 2) examined the effects of invasions and extinctions in Mediterranean-climate ecosystems on body mass structure and alpha, beta and gamma diversity.

Data sets were developed from published literature and by communications with scientists in five countries. Pablo Marquet (Catholic University of Chile) provided assistance with analyses on bird and mammal community body mass distributions in North and South America that focused on the effect of changes in spatial scale on body mass distributions. A socio-ecological model was being developed to determine the factors most influential on the number of endangered and invasive bird and mammal species, on a country by country scale, throughout the world. David Lambert (Louisiana School for Math, Science, and the Arts) provided assistance for the analyses on mammal community body mass distributions in North America (Bridger Basin area, Florida, and Nebraska) with a focus on the effect of geological time on body mass distributions.

Discontinuous body-mass distributions were found in all Mediterranean climate ecosystems and taxa that were examined. More invasive and endangered species were found to occur at the edges of body mass aggregations than could be expected by chance in 40% of datasets and in all datasets when analyzed by taxonomic group. This supports the hypotheses suggesting a relationship between discontinuities in body size distributions and invasion and decline.

Analyses have been completed. The introduction of invasive species and loss of declining species resulted in a general decrease in alpha functional diversity, contrary to expectations. Beta functional diversity decreased in birds and in most of the mammal comparisons, which supports studies reporting a regional scale decline in species diversity following invasions.

OTHER AFFILIATED RESEARCH PROJECTS

The following research projects are being lead by non-unit faculty. They are funded through the USGS Cooperative Research Units Research Work Order process, or by modifications to the Nebraska Game and Parks Commission Cooperative Agreement.

MULTI-CRITERIA ASSESSMENT OF HABITAT RESTORATION FOR THE MISSOURI RIVER

Principal Investigator: John Stansbury (PI), Istvan Bogardi

Graduate Student(s): Jennifer Gitt

Project Duration: August 20, 2007 – September 30, 2009

Funding: U.S. Geological Survey and U.S. Army Corps of Engineers (RWO 7)

Project Location: Missouri River

This project is focused on restoration of habitat for three endangered or threatened species: pallid sturgeon, least tern, and piping plover. Management and restoration of the Missouri River is a complex endeavor that affects many people with many and often conflicting priorities. For example, habitat restoration activities for one species may interfere with habitat needs for another species. The primary objective of this project is to develop a multi-criteria assessment tool that can be used to assess the overall status and progress of the habitat restoration efforts on the Missouri River (or portions of the river) to help the U.S. Army Corps of Engineers and cooperators assess the status and the progress of the habitat restoration program. Secondary objectives are to determine the indicators needed to make an overall assessment of the habitat and to develop methods to collect and measure those indicators.

PRODUCTIVITY AND BIOLOGY OF DUCKS NESTING IN THE SANDHILLS OF NEBRASKA

Principal Investigator: Larkin Powell

Graduate Student(s): Zachary Cunningham

Project Duration: January 1, 2007 – December 31, 2009

Funding: Nebraska Game and Parks Commission

Project Location: Nebraska Sandhills

While the grasslands in the Nebraska Sandhills do not appear to be at high risk of conversion to cropland, the potential risk does exist. In addition, the wetlands and soils of the Sandhills face other threats such as sale of groundwater to high-demand areas. Potential developers need information to help assess the inherent risks to the wildlife populations that depend on this unique landscape for survival. This project is evaluating the importance of Sandhills wetlands to duck populations. The study intends to 1) design and develop an annual, repeatable brood survey for estimating relative production across the Sandhills; 2) conduct the brood survey for two years and refine survey and analysis methods; 3)

examine female age ratios of ducks nesting in the Sandhills; 4) examine patterns of recaptured male mallards south of Bassett, Nebraska; and 5) determine the origin of females nesting in the Sandhills via feather stable isotopes (depending on additional funding).

QUANTIFYING UNCERTAINTY IN MISSOURI RIVER ADAPTIVE MANAGEMENT PROCESSES

Principal Investigator:	Andrew Tyre (PI), Erkan Istanbullouglu
Graduate Student(s):	Jonathan Ray
Project Duration:	April 2009 – December 2010
Funding:	U.S. Geological Survey (RWO 9) U.S. Army Corps of Engineers
Project Location:	Missouri River Basin from Montana to Missouri

The Missouri River Recovery Project (MRRP) is arguably one of the largest ecosystem recovery projects ever attempted. Choosing actions and resolving conflicts among stakeholders is difficult because predicting the consequences of actions if fraught with uncertainty. This is particularly true of endangered species responses to recovery actions. In response to this uncertainty, the U.S. Army Corps of Engineers (USACE) has committed to taking an adaptive management approach to the recovery of the Missouri River. Initial efforts at developing adaptive management plans for endangered species are presently underway. However, building a predictive capacity that integrates hydrology, climate, sociology, and ecology is technically challenging. The critical need is for a linked set of decision tools that provides a simple and transparent linkage between management actions and responses. These linked tools can only be built by a dedicated team of scientists with expertise in all of the disciplines as well as a strong central linkage. Without this dedicated team, the development of the necessary integrated science takes place only slowly, if at all.

The long term goal of this project is to develop an integrated system of predictive tools used iteratively to guide the recovery project. Ultimately, the capacity to both develop and use these tools needs to be transferred to the management agency, the USACE. Thus, training is needed in addition to scientific development.

The specific goals of this project are:

1) Quantify uncertainty in ecological responses to management in a manner that is useful for decision makers.
2) Develop decision support tools that link hydrological inputs with ecological outputs and use existing monitoring data both as validation and to improve parameter estimation.
3) Train USACE and other federal agency personnel in the use of these tools to ensure the continued development of the tools and successful use beyond the life of the project.

The primary outcome of this project will be a decision support system that is trusted and highly regarded by the diverse stakeholders in the Missouri River Basin. This will lead to improved medium to long term decision making in the Recovery Project, and these decisions will be robust and unlikely to be challenged by stakeholders. The system will be flexible enough to adapt as new challenges emerge. The adaptive management expertise and technical modeling capacity built within the USACE during the project will be transferable to other river management issues at many scales.

Stable Isotope Determination in Deer and Mountain Lion Tissue

Principal Investigator: Larkin Powell

Graduate Student(s): none

Project Duration: May 1, 2008 – May 1, 2009

Funding: Nebraska Game and Parks Commission

Project Location: State of Nebraska

Large-scale movements of mammals in Nebraska are difficult to track using traditional mark-recapture techniques. Our objective was to determine if stable isotopes (hydrogen and carbon) could be used to track large mammal movements. As hypothesized, we were able to use stable isotope analyses to predict the probability of origin among several potential source populations in the Great Plains. Our results lay the foundation for future analyses of stable isotope signatures from dispersing animals in Nebraska to assess range expansions, disease transmission, or meta-population dynamics. Lymph node tissues were sampled from white-tailed deer at Nebraska harvest check stations. An 'isoscape' was created for Nebraska, showing deer in western Nebraska had a markedly lighter hydrogen signature than deer from the east. The carbon signature in deer was related to dominate vegetation (crops or native vegetation) in the region. Our research is the first to show fine-scale changes in stable isotope signatures within a state. We then sampled claws from four mountain lions collected at their death site from Valentine and Gretna, NE; Chicago, IL; and Saskatoon, SK. We sampled the claw tissue in ca.1-mm samples from claw tip to claw root, and performed stable isotope analyses on each sample. We hypothesized that dispersing mountain lions would incorporate the changing isotope signature from their dispersal landscape. Indeed, all mountain lions showed predictable variation in stable isotope signatures. The SK and Valentine, NE mountain lions were originally radio-collared in South Dakota. They were used as control samples to confirm that our predictions of dispersal origins were correct. All four animals appeared to have originated in the Black Hills.

Total Vegetation Control on Sandbars along the Missouri River Utilizing Lime and Herbicides

Principal Investigator: Stevan Knezevic (PI), Charlie Shapiro, Tom Hunt, Mark Bernards

Post-Doc: Avishek Datta

Project Duration: June 1, 2007 – December 31, 2009

Funding: U.S. Geological Survey and U.S. Army Corps of Engineers (RWO 6)

Project Location: Missouri River

Lack of bare sand areas due to vegetative overgrowth is the main reason for the reduction of nesting habitats for two endangered bird species, piping plover (*Charadrius melodus*) and interior least tern (*Sterna antillarum*), in the backwaters of Lewis and Clark Lake along the Missouri River. To create suitable nesting habitats (e.g., large open bare sand), a series of vegetation management practices are being tested on the existing sandbars. It is important to identify practices that will maintain sandbars free of vegetation; thus, protect proper nesting habitats for the above bird species. We are in the 2nd year of studying the effects of lime, ash, and imazapyr either applied alone or in combination as tools for long-term vegetation control in maintaining suitable habitat for piping plover and interior least tern on the existing sandbars.

PROFESSIONAL ACTIVITIES

TEACHING

CRAIG ALLEN

Spring 2009: *Foundations of Ecological Resilience*

This new course developed an understanding of the concept of resilience, especially ecological resilience. Students explored both theoretical and applied aspects of ecological resilience, and the development of resilience theory. To further explore these concepts, students developed and completed a group project focusing on a resilience assessment of the Platte River Valley. At the conclusion of the course, students were familiar with a number of prominent issues in resilience theory, its development and application.

KEVIN POPE

Spring 2009: *Managed Aquatic Systems*

This course, team-taught with Mark Pegg (UNL School of Natural Resources), was designed to increase students' understanding of ecological processes that occur in regulated river basins and associated problems or opportunities that arise with fishery management. The focus was primarily on fishes and understanding how structure, process and function of aquatic systems are influenced by human activities. A unique aspect of this course is the presence of both professors in the classroom; that is, this course is truly team-taught, providing students the formal opportunity to interact with two faculty members that have differing experiences and sometimes differing opinions.

AARON LOTZ (PH.D. CANDIDATE)

Spring 2009: *Wildlife Ecology and Management (NRES 311)*

This course explored concepts in wildlife ecology, conservation biology, population biology, and managing for of wildlife population enhancement. Emphasis was placed on game and nongame species, as well as management options that include human/wildlife interactions, habitat, and wildlife populations.

TRAINING AND WORKSHOPS

CRAIG ALLEN

- Workshop co–instructor and presenter, *Discontinuities in Complex Adaptive Systems Workshop* at the International Institute of Applied Systems Analysis in Laxenburg, Austria, in November 2008.

KEVIN POPE

- Instructor, Conservation Leaders for Tomorrow Program (Max McGraw Wildlife Foundation), Dundee, Illinois, February 2009

PEER-REVIEWED PUBLICATIONS

Allen, C. R. 2009. *In press*. Wildlife Science: Linking Ecological Theory and Management Applications (book review). Great Plains Research 19.

Allen, C. R., A. Alai, A. Kessler, T. Kinsell, A. Major, K. Nemec and B. Stevens. 2008. Invasive Plants: A Guide to Identification, Impacts, and Control of Common North American Species (book review). Great Plains Research 18:234.

Allen, C. R., E. A. Forys, and C. S. Holling. 2009. Body mass patterns predict invasions and extinctions in transforming landscapes. Chapter XX in Gunderson, L., C. R. Allen and C. S. Holling, Editors. Foundations of Resilience. Island Press. (I*n press*). (Reprinted from Ecosystems 2:114–121.)

Allen, C. R., L. Gunderson, and C. S. Holling. 2009. Part 1 Concepts and Theory – commentaries on articles. Chapter XX *in* Gunderson, L., C. R. Allen and C. S. Holling, Editors. Foundations of Resilience. Island Press. *In press.*

Allen, C. R., L. Gunderson, and C. S. Holling. 2009. Part 2 ecological examples – commentaries on articles. Chapter XX in Gunderson, L., C. R. Allen and C. S. Holling, Editors. Foundations of Resilience. Island Press. I*n press.*

Allen, C. R., L. Gunderson, and C. S. Holling. 2009. Part 3 Empirics and models – commentaries on articles Chapter XX in Gunderson, L., C. R. Allen and C. S. Holling, Editors. Foundations of Resilience. Island Press. I*n press.*

Allen, C. R. and C. S. Holling. 2008. Cross-scale structure and the generation of innovation and novelty in discontinuous complex systems. Pages 219–233 in Allen, C. R. and C. S. Holling, editors. Discontinuities in Ecosystems and other Complex Systems. University of Columbia Press, New York, NY.

Allen, C. R. and C. S. Holling. I*n press*. Thresholds and the generation of novelty. Ecology and Society.

Allen, C. R., and C. S. Holling, Editors. 2008. Discontinuities in Ecosystems and other Complex Systems. University of Columbia Press, New York, NY. 272 pp.

Chizinski, C. J., B. Sharma, K. L. Pope, and R. Patiño. 2008. A bioenergetics model for zebrafish. *Danio rerio* (Hamilton). Journal of Fish Biology 73:35–43.

Chizinski, C. J., C. G. Huber, and K. L. Pope. 2008. Development and validation of a bioenergetics model for inland silverside in freshwater systems. Transactions of the American Fisheries Society 137:254–261.

Epperson, D. and C. R. Allen. 2009. Red imported fire ant impacts on upland arthropods in southern Mississippi. American Midland Naturist. I*n press.*

Fontaine, J. J. and C. van Riper. 2009. A neotropical migrant bird's dilemma. Where to stop for a good meal. U.S.G.S. Fact Sheet 2009–3038 [http://pubs.usgs.gov/fs/2009/3038/].

Fontaine, J. J. and K. L. Decker. 2009. Exploring predation and animal coloration through outdoor activity. Science Activities 45:3–7.

Fontaine, J. J., K. L. Decker, S. K. Skagen and C. van Riper III. *In press*. Spatial and temporal variation in climate change: A bird's eye view. Climatic Change.

Garmestani, A. S., C. R. Allen, and K. M. Bessey. 2008. Discontinuities in urban systems comparison of regional city-size structure in the United States. Pages 136–164 in Allen, C. R. and C. S. Holling, editors. Discontinuities in Ecosystems and other Complex Systems. University of Columbia Press, New York, NY.

Garmestani, A. S., C. R. Allen and H. Cabezas. 2009. Panarchy, adaptive management and governance: sustainable options for building resilience. Nebraska Law Review 87:1036–1054.

Garmestani, A. S., C. R. Allen and C. M. Gallagher. 2008. Power laws, discontinuities and regional city size distributions. Journal of Economic Behavior and Organization 68:209–216.

Garmestani, A. S., C. R. Allen and L. Gunderson. 2009. Panarchy discontinuities reveal similarities in the dynamic system structure of ecological and social systems. Ecology and Society 14 (1) 15. [online] URL: http://www.ecologyandsociety.org/vol14/iss1/art15/

Gunderson, L., C. R. Allen and C. S. Holling. 2009. Conclusion – The evolution of an idea; the past, present and future of ecological resilience. *In* Gunderson, L., C. R. Allen and C. S. Holling, Editors. Foundations of Resilience. Island Press. I*n press.*

Gunderson, L., C. R. Allen and C. S. Holling. 2009. Foundations of Resilience. Island Press, New York, NY. ~311pp.

Gunderson, L., C. R. Allen and C. S. Holling. 2009. Why resilience? Why now? Chapter 1 *in* Gunderson, L., C. R. Allen and C. S. Holling, Editors. Foundations of Resilience. Island Press. I*n press*.

Holling, C. S., C. R. Allen, and G.D. Peterson. 2008. Panarchies and discontinuities. Pages 3–19 *in* Allen, C. R. and C. S. Holling, editors. Discontinuities in Ecosystems and other Complex Systems. University of Columbia Press, New York, NY.

Martin, D. R., L. A. Powell, and K. L. Pope. *In press.* Spring home ranges of white bass in irrigation reservoirs of the Republican River Basin, Nebraska. Ecology of Freshwater Fish.

McGrath, L. J., C. van Riper, and J. J. Fontaine. 2009. Flower power: Tree flowering phenology as a settlement cue for migrating birds. Journal of Animal Ecology 78:22–30.

Pope, K. L., R. M. Neumann, and S. D. Bryan. 2009. Warmwater fish in small standing waters. Pages 13–27 *in* S. A. Bonar, W. A. Hubert, and D. W. Willis, editors. Standard methods for sampling North American freshwater fishes. American Fisheries Society, Bethesda, Maryland.

Robertson, B. A., B. A. Schwartz, E. Loomis and J. J. Fontaine. *In press*. Protracted song ontogeny in a suboscine passerine. Wilson Journal of Ornithology.

Wardwell, D. and C. R. Allen. 2009. Variability in population abundance is associated with thresholds between scaling regimes. Ecology and Society. *In press*.

Wardwell, D., C. R. Allen, G. D. Peterson and A. D. Tyre. 2008. A test of the cross-scale resilience model: functional richness in Mediterranean-climate ecosystems. Ecological Complexity 5:165–182.

Wilde, G. R., and K. L. Pope. 2008. A simple model for predicting survival of angler-caught and released largemouth bass. Transactions of the American Fisheries Society 137:834–840.

Presentations at Scientific Meetings

Allen, C. R. 2008. Invasive Species Threats. School of Natural Resources public lecture, Lincoln, NE. Invited presentation.

Allen, C. R. 2008. Phenomena associated with discontinuities. Discontinuities in Complex Adaptive Systems Workshop, International Institute for Complex Systems Analysis, Vienna, Austria. November. Invited presentation.

Allen, C. R. 2009. Resilience and Invasions. Special Session – Islands of Sorrow, Islands of Hope: Resilience and Sustainability in Island Social-Ecological Systems, ESA Annual Meeting, Albuquerque, NM. August. Invited presentation.

Allen, C. R. 2009. Resilience, discontinuity and novelty in complex systems. 10th Annual Conference on Ecological Integration, Texas A&M University, College Station, TX. March. Invited presentation.

Allen, C. R. 2008. Resilience, novelty, and discontinuities. Kansas State University Biology Department Seminar Series, Manhattan, KS. Invited presentation.

Allen, C. R., and A. Lotz. 2009. Rainwater Basin Joint Venture 14th Annual Informational Seminar, Hastings, NE. Invited presentation. February.

Fontaine, J. J, C. van Riper, and S. Skagen. 2009. Climate, phenology and avian migration patterns in the desert southwest? The annual meeting of the Cooper Ornithological Society, Tucson, AZ. April.

Fontaine, J. J, C. van Riper, and S. Skagen. 2009. Do geographical influences on plant phenology drive avian migration patterns in the desert southwest? Joint meeting of the AZ/NM chapter of The Wildlife Society, Gallup, NM.

Fontaine, J. J. 2009. The influence of tree phenology on avian migration patterns and the potential role of climate change. Williams Memorial Lecturer, School of Natural Resources Spring Water Series, University of Nebraska–Lincoln, Lincoln, NE. March.

Furman, A. J., A. P. Maple, M. A. Pegg, and K. L. Pope. 2009. Influence of latitude on methods of aging bluegill. 15th Annual Undergraduate Research Conference, University of Nebraska–Lincoln, Lincoln, NE, April. Poster presentation.

Garmestani, A., C. R. Allen, and H. Cabezas. 2008. Panarchy, Sustainability and American Law. Environmental Law and Resilience Symposium, Lincoln, NE. Invited presentation.

Martin, Dustin and Pope, K .L. 2009. Influence of substitute sites on management actions. American Fisheries Society Annual Meeting, Nashville, TN. August.

Martin, Dustin. 2009. Habitat selection by spawning walleye in irrigation reservoirs of the Republican River Basin, Nebraska. Annual Meeting of Izaak Walton League, Lincoln, NE. January.

Nemec, K., and C. R. Allen. 2009. The relationship between diversity and invasion resistance in wet-mesic tallgrass prairie restorations. ESA Annual Meeting, Albuquerque, NM. August.

Nemec, K. T., and C. R. Allen. 2009. The relationship between diversity and invasion resistance in wet-mesic tallgrass prairie restorations. Ecological Society of America, Albuquerque, NM. August.

Pope, K. L., and G. R. Wilde. 2008. Latitudinal variation in maximum weight of angler – caught fishes. 5th World Recreational Fishing Conference, Dania Beach, FL. November.

Rehme, S. E., C. R. Allen, and L.A . Powell. 2009. Grassland songbird community diversity, evenness, and nest survival vary with park size and latitude. ESA Annual Meeting, Albuquerque, NM. August.

Richters, L. K., D. R. Martin, and K. L. Pope. 2008. Channel catfish catches in tandem hoop nets : the influence of sampling data. 69th Annual Meeting of the Midwest Fish and Wildlife Conference, Columbus, OH. December.

Richters, Lindsey. 2009. The Influence of stocking densities and habitat variability on channel catfish populations in Nebraska. American Fisheries Society Meeting, Nashville, TN. August.

Smith, Chad and Tom St. Clair. 2009. Adaptive Introduction to Collaborative Adaptive Management. National Conference on Ecosystem Restoration, Los Angeles, CA. July.

Smith, Chad. 2009. Adaptive Management Decision Support and Collaboration on the Platte River. American Water Resources Association Adaptive Management Summer Specialty Conference, Snowbird, UT. June.

Smith, Chad. 2009. Adaptive Management on the Platte River – Governance and Lessons Learned. National Conference on Ecosystem Restoration, Los Angeles, CA. July.

Smith, Chad. 2008. From Design to Experiment – Simple Modeling Techniques for Platte River Adaptive Management. University of Nebraska–Lincoln School of Natural Resources Water Colloquium, Lincoln, NE.

Smith, Chad. 2009. Land, Water, and Adaptive Management – Science and Engineering for Species Recovery on the Platte River. National Conference on Ecosystem Restoration, Los Angeles, CA. July.

Sundstrom, S., and C. R. Allen. 2009. Predictors of the decline of grassland birds Multi-causal and multi-scalar. ESA Annual Meeting, Albuquerque, NM. August.

Wilde, G. R. and K. L. Pope. 2008. A conceptual model for trophy fish production. 5th World Recreational Fishing Conference, Dania Beach, FL. November.

Williams, J. B., and C. R. Allen. 2008. Risk Assessment for Potential Invasive Plants in Nebraska. 69th Midwest Fish and Wildlife Conference, Columbus, OH. December.

Graduate Committee Service

Craig Allen

- Matthew Child (MS, University of Cape Town) External examiner (2008)
- James Eckberg(Ph.D., School of Biological Sciences, UNL) Graduated 2008
- Andrew Kessler (M.S. ,School of Natural Resources, UNL)
- Jamie McFadden (M.S. School of Natural Resources, UNL)
- Dori Porter (MS, Entomology, UNL)

Kevin Pope

- Tara Anderson (M.S., School of Natural Resources, UNL)
- Michael Archer (M.S., School of Natural Resources, UNL)
- Tony Barada (M.S., School of Natural Resources, UNL)
- Cameron Goble (M.S., School of Natural Resources, UNL)
- Brenda Pracheil (Ph.D., School of Natural Resources, UNL)

Professional and Faculty Service

Craig Allen

- Associate Editor (Macro and Landscape Ecology), Ecology and Society
- Board of Directors, The Resilience Alliance (http://www.resalliance.org)
- Steering Committee, Nebraska Partnership for All-Bird Conservation
- Fellow, Center for Great Plains Studies and Member: Scholarship Committee
- Core Team, Invasive Plants State Technical Committee, Natural Resources Conservation Service (NRCS), January 2006 – Present
- Associate, Center for Grassland Studies, University of Nebraska
- Alternate committee member, Institutional Animal Care and Use Committee, UNL
- Working group member, USGS Aquatic Gap Analysis Program
- Working group member, USGS Adaptive Management Working Group
- Guest Editor, Southeastern Naturalist. December 2008
- Ad–hoc editor, Conservation Biology. December 2008
- Invited Panel Member, Lower Platter River Corridor Alliance. November, 2008
- Session Chair, Resilience 2008 session: Complex systems, resource management and economic development (Stockholm, Sweden)

Kevin Pope

- President, Nebraska Chapter, American Fisheries Society
- Associate Editor, Transactions of the American Fisheries Society
- Book Editorial Advisory Board, American Fisheries Society
- Research Committee, UNL School of Natural Resources
- Graduate Committee, UNL School of Natural Resources

Joseph Fontaine

- Local committee chair, Cooper Ornithological Society Annual Meeting 2009 Tucson, AZ
- Member of the graduate student awards committee, Cooper Ornithological Society

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