

IN COOPERATION WITH:



S.J. & JESSIE E. QUINSEY  
COLLEGE OF  
NATURAL RESOURCES  
UtahStateUniversity



# Annual Report 2016

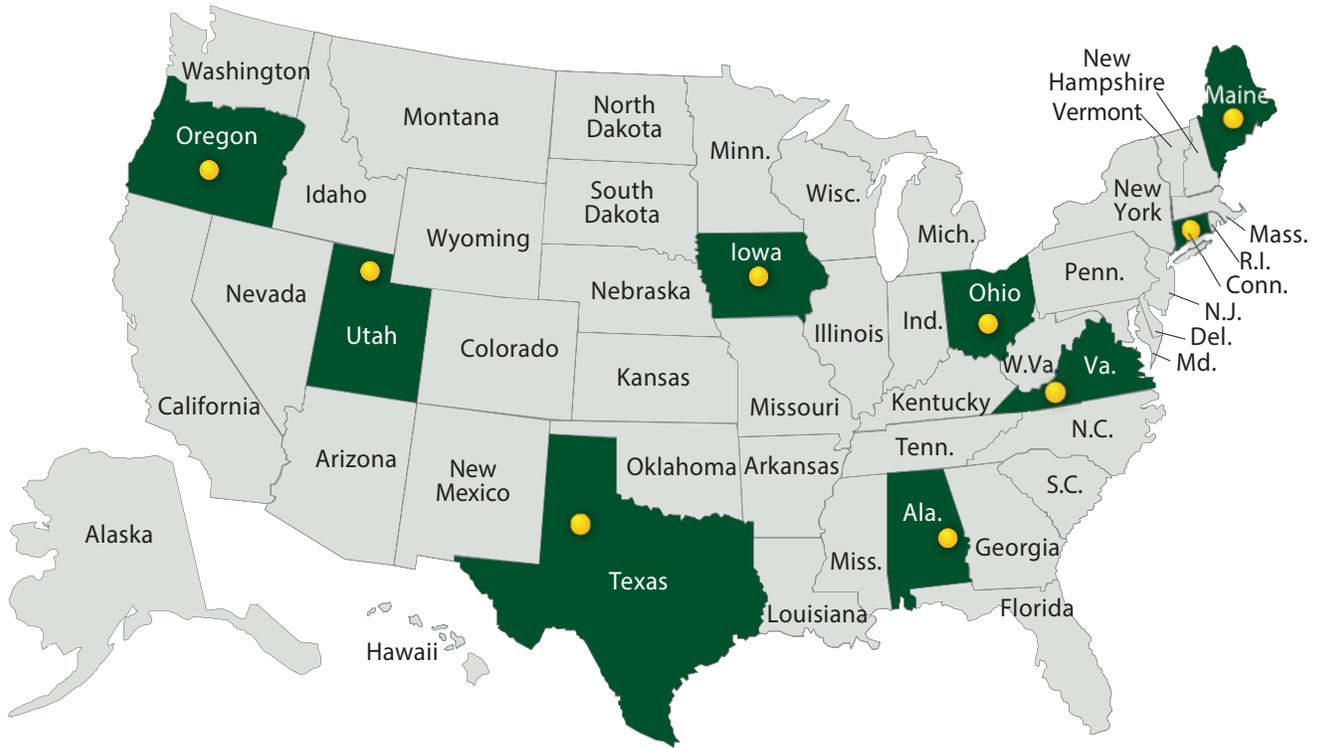
U.S. Geological Survey, Utah Cooperative  
Fish & Wildlife Research Unit

U.S. Geological Survey - Utah Division of Wildlife Resources - Utah State University  
U.S. Fish and Wildlife Service - Wildlife Management Institute

*Brief History  
of  
U.S. Geological Survey Cooperative Fish  
& Wildlife Research Units*

*The Cooperative Fish and Wildlife Research Units date back to 1932 when J.N. “Ding” Darling invested \$3,000 to establish the first Unit in Iowa. This investment was in response to reading a report prepared by Aldo Leopold and 14 other prominent conservationists. This influential report boldly stated that, “wildlife demand was stripping supply,” and there was a need to educate personnel to solve the wildlife conservation problems and to conduct research for wildlife management.*

*Three years later the first nine Units were established at land-grant universities. Utah was chosen to be one of the original nine established and was to represent the Intermountain West. Now 80 years later there are 40 Coop Units housed in land-grant universities across the United States including Alaska and Hawaii.*



1935: First 9 Units



2016: 40 Current Units

# Research Highlights

## The Beaver: Helping Keep Water on Drying Lands

Beginning as early as the 17th century, beavers have struggled to find safe places to build their homes.

Initially, hunters trapped beaver extensively to keep up with the popular beaver fashions in Europe. Then as settlers began moving west, they considered the beavers annoying because of their tendency to cause flooding and damage trees - so the trapping continued.

However, today in many parts of the American West the beaver's 400-year-old struggle is fading because of their ability to keep water on dry land in an efficient manner.

While beavers may not be welcome in most city limits, ranchers and wildlife managers are re-introducing them to rural areas where the benefits of their dams far outweigh the inconveniences.

One such place is the Della Ranches in west Box Elder County, where the Tanner family has been ranching for six generations. The ranch is located in a remote part of the state and has some of the best intact sagebrush habitat in Utah with strong populations of sage grouse and mule deer.

Most of the precipitation on the ranch, which averages less than 12 inches a year, comes as snow during winter and rain in April and May. By the end

of the summer, the majority of the streams have dried up.

Having a sustainable water supply is an ongoing concern for the Tanners. They are searching for ways to keep water on the land throughout the summer.

Jay Tanner explains, "I considered building a reservoir or pond but it would be expensive, require quite a bit of maintenance, and permits. Beaver dams on the other hand are inexpensive, sustainable, and self-maintained."

Kent Sorenson, habitat biologist from the Utah Division of Wildlife Resources described the financial benefit of the beavers, "[When beaver manage the dams] our operation and maintenance costs go to zero — they do all the work. They are 24/7 - 365-day maintenance crews that do not require a Corps of Engineers 404 permit.

When Jay Tanner learned of the potential benefit of beavers, he drove to Utah State University and met with scientists and researchers who had experienced success in restoring beavers in the west.

Eric Thacker, Rangeland Management Extension Specialist at USU said, "A beaver dam provides a buffer or mitigation for drought." Once the dams are established, they keep the water on the land. This is beneficial to fish, wildlife and livestock.

Sage-grouse hens like to gather with their chicks in the wet meadows by beaver dams, where they can find plenty of insects and vegetation for their chicks.

After further discussions with USU, the Tanners entered into a multi-year partnership with the Quinney College of Natural Resources and Utah Division of Wildlife Resources to reintroduce beaver to their ranch. Currently, all involved are working to make the streams and surrounding area appropriate for new beaver families. Once the areas are ready and the correct permits are in place, UDWR will capture a beaver pair, keep them in quarantine for the appropriate amount of time then introduce the beavers to a stream on the Tanner Ranch.

Reintroducing a beaver couple instead of a single beaver is essential for the success of the project. They are social critters. Beaver will leave the location and go searching for a partner if they are not re-introduced with one.

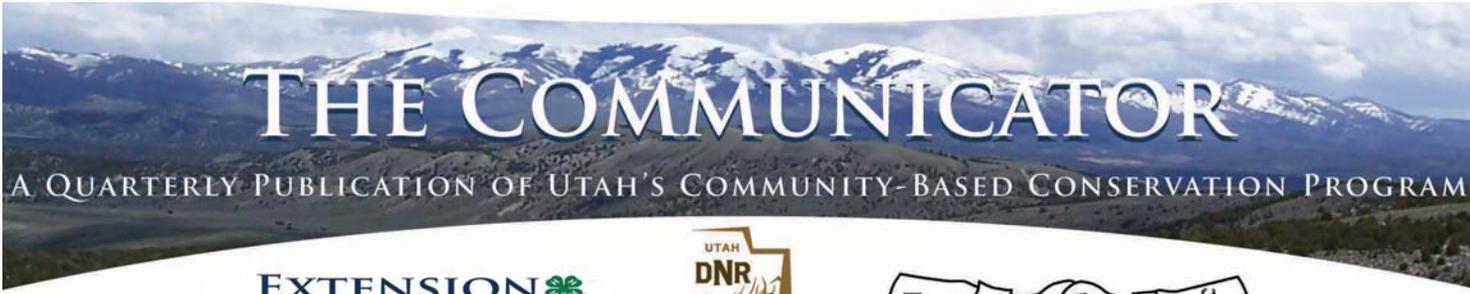
In an established beaver dam, you will likely find monogamous parents with their babies called "kits", their yearlings, and extended families.

Joseph Wheaton, Associate Professor in the department of Watershed Sciences and Principal Investigator on the project said, "If [this] project is successful, the implications are huge for instream and riparian restoration throughout the state of Utah as beaver are potentially an extremely cost-effective form of restoration..."



Photo provided by USFWS

*This piece aired on UPR's Wild About Utah the week of April 17-21, 2017*



**EXTENSION**   
**UtahStateUniversity**



January 2017 Volume 13, Issue 1

**LOCAL KNOWLEDGE - LOCAL SOLUTIONS:  
 THE ROLE OF COMMUNITY-BASED CONSERVATION IN SAGE-GROUSE  
 SCIENCE, MANAGEMENT, AND POLICY**

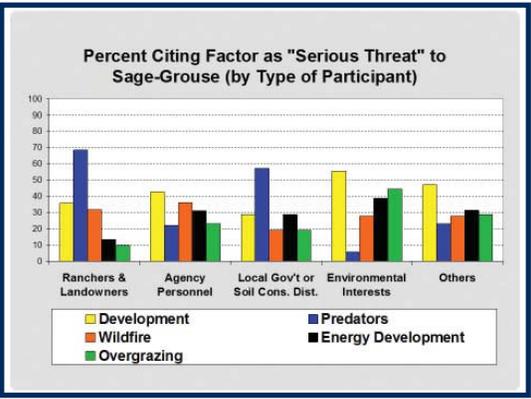
By Terry Messmer, Utah State University

Some 20 years ago, I attended a meeting in Montana sponsored by the Rocky Mountain Elk Foundation under the initiative “Seeking Common Ground.” The initiative revolved around the impact increasing elk populations were having on ranching. The meeting was well attended with over 200 people present including a lot of local ranchers. The meeting facilitator opened the meeting with a call for increased collaboration among all in attendance. Suddenly, the large meeting hall was filled with a loud pounding noise that resonated throughout the hall, interrupting the facilitator and drawing attention to the source of the outburst. I happened to be sitting next to the source. The source of the noise was a local rancher, a WWII veteran, who had pounded his fist into the table when he heard the word “*collaboration*.”

He broke the uncomfortable silence he had created with his pounding fist with this statement. “Do you know what we did with collaborators in WWII,” he paused for effect then added, “We shot them”! Needless to say, his comments changed the entire dynamics of the room and meeting.

Depending on what dictionary or source you use, you can find multiple definitions of the word “collaboration.” One of them is “working with the enemy.” Since WWII and more recently the word collaboration has been applied to processes initiated over the last 20 years to being individuals and groups together to work on difficult natural resource or social issues to resolve deep conflicts. In almost all of these cases, the individuals and the groups they may represent have no history of working together because they have different interests, values, and perceptions and thus their perspectives differ greatly on what is the best approach to resolve the issue. They may have been, or are now, actual litigants seeking some remedy through the courts.

In 1996, Utah State University and the Utah Division of Wildlife Resources made a bold decision to “collaborate” with those most affected by conservation policy to develop a community-based conservation (CBCP) adaptive resources management local



**IN THIS ISSUE**

LOCAL KNOWLEDGE - LOCAL SOLUTIONS:  
 THE ROLE OF COMMUNITY-BASED  
 CONSERVATION IN SAGE-GROUSE  
 SCIENCE, MANAGEMENT, AND POLICY.....1

LOCAL KNOWLEDGE - LOCAL SOLUTIONS, CONT..2

USU RESEARCH PROVIDES THE BEST  
 AVAILABLE SCIENCE TO GUIDE UTAH'S  
 CONSERVATION STRATEGY.....3

THE GREATER SAGE-GROUSE GOES TO  
 SCHOOL IN KANAB.....4

CBCP MISSION STATEMENT.....4

Story continues on page 32.

# Mission Statement

## Utah Cooperative Fish and Wildlife Research UDWR - Utah

In 2016, the Utah Cooperative Fish and Wildlife Research Unit celebrates its **81st year** of educating future wildlife and fisheries managers and conducting fish and wildlife research – all in an effort to preserve the natural resources of the Intermountain West. This is all possible due to the Agreement among its cooperators, Utah Division of Wildlife Resources (UDWR), the U.S. Geological Survey (USGS), and Utah State University. The Wildlife Management Institute and U.S. Fish and Wildlife Service also participate.

The major limiting influences on fish and wildlife resources in the Intermountain West are terrestrial habitat degradation and loss, and watershed and water development issues. Rapid population growth in the state, coupled with societal desires to access the wide range of natural resources available in the state, has exacerbated the pressures on both terrestrial and aquatic resources. These pressures require novel approaches to the study of, and transfer of research results to, those tasked with the responsibility to blend research information on the status and health of the state's terrestrial and aquatic ecosystems with other societal values. The

Unit's principal role is to serve as nexus for the collection of this important information. We achieve this through excellence in research, instruction, and interaction with cooperators.

Research expertise of the Unit staff includes: landscape ecology, conservation biology, research design and applied statistics, larger scale animal dynamics, geographical information system and habitat restoration methodology, terrestrial and aquatic habitat analysis, population management and assessment, fish population dynamics, and aquatic food web dynamics. Current research activities focus on landscape-level habitat studies, ecological modeling of lake, reservoir, and riverine systems, avian and terrestrial ecology, and the effects of climate change on habitat and biota throughout the Intermountain West. Future research directions of the Unit will continue to involve endangered fish and wildlife species, sustainable game and sport fish management, and landscape-level studies involving modeling for future climate scenarios.

Primary graduate and cross-listed graduate/undergraduate level

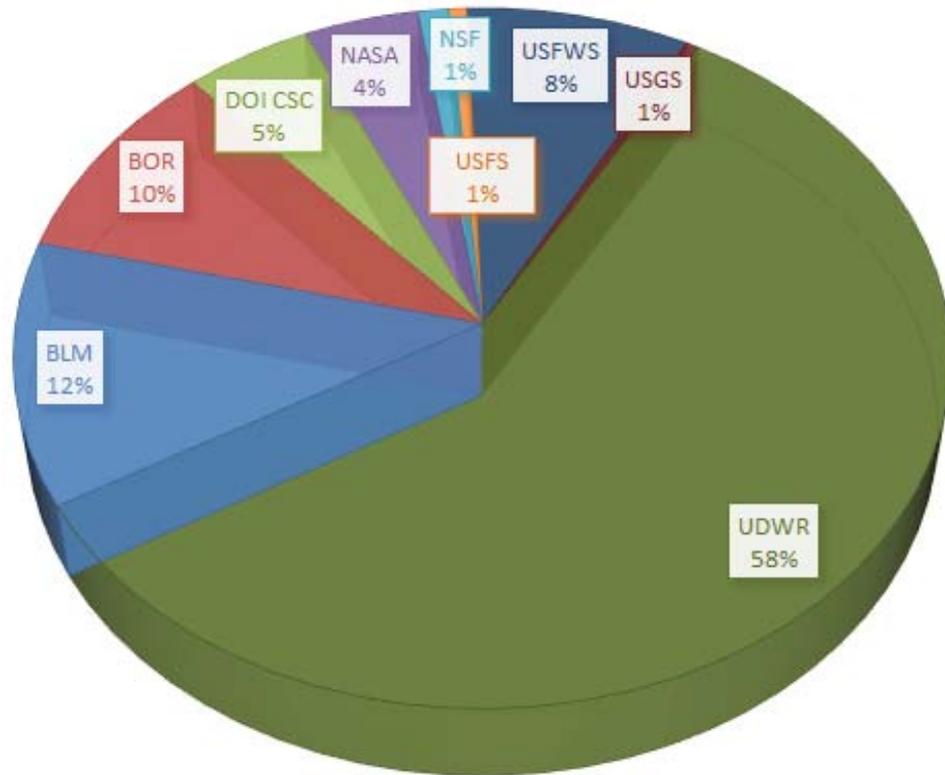
courses taught by unit personnel include Design and Analysis of Ecological Research (WILD 6500, emphasizes the research process), Graduate Fish Ecology (WATS 6230), and Fish Diversity and Conservation. Unit personnel have also developed and provide instruction in continuing education and professional advancement short courses for agency personnel, with a current emphasis on analytical tools used by DWR biologists. The Unit also facilitates instruction in a diverse array of workshops developed by cooperating Faculty at QCNR to a wide range of agency cooperators as well.

Cooperating faculty in the Quinney College of Natural Resources (QCNR), the Ecology Center, and across the University (USU) are, and will continue to be, integrated into Unit research to apply diverse expertise to all facets of a research problem. The primary goal of the Unit is to provide high quality information necessary to help resolve pressing natural resource problems. The Unit strives to do this by bringing to bear expertise found not only in the Unit staff, but also in the diversity of cooperating faculty found at USU.



Photo by Colton Finch

## 2016 Research Contracts & Grants Funding Summary by Source



**UDWR** - Utah Division of Wildlife Resources

**USGS** - U.S. Geological Survey

**BLM** - Bureau of Land Management

**BOR** - Bureau of Reclamation

**USFWS** - U.S. Fish and Wildlife Service

**DOI CSC** - South Central Climate Science Center

**NASA** - National Aeronautics and Space Administration

**NSF** - National Science Foundation

**USFS** - U.S. Forest Service



# Sampling of USU Alumni Working for UDWR

Name	Job Title	USU College	Major	Degree
J.D. Abbott	<b>Sergeant</b>	NR	Fisheries & Aquatics	BS
Paul Vincent Badame	<b>Wildlife Coordinator</b>	NR	Fisheries & Wildlife	BS
J. William (Bill) Bates	<b>Wildlife Section Chief</b>	NR	Fisheries & Wildlife	MS
Thomas W. Becker	<b>Wildlife Biologist</b>	NR	Fisheries & Wildlife	BS
Melinda Bennion	<b>Aquatic Biologist II</b>	NR	Natural Resources	MNR
Heather Hill Bernales	<b>Biometrician</b>	NR	Wildlife Biology	MS
David L. Beveridge	<b>Lieutenant</b>	NR	Fisheries & Wildlife	BS
Gary John Bezzant	<b>Regional Habitat Manager</b>	NR	Human Resources	MS
Garn J. Birchell	<b>Asst Aquatics Program Manager</b>	NR	Fisheries & Wildlife	MS
Calvin M. Black	<b>Asst Aquatics Program Manager</b>	NR	Fisheries & Wildlife	BS
Natalie Boren	<b>Biologist</b>	NR	Natural Resources	BS, MNR
Quentin Bradwisch	<b>Native Aquatics Biologist</b>	NR	Fisheries & Wildlife	BS
Adam Brewerton	<b>Conservation Wildlife Biologist</b>	NR	Ecology	MS
Matthew G. Briggs	<b>Sergeant</b>	NR	Fisheries & Wildlife	BS
Michael F. Canning	<b>Assistant Director</b>	NR	Aquatic Ecology	MS
Torrey Christophersen	<b>Lieutenant</b>	NR	Fisheries & Wildlife	BS
Bryan Christensen	<b>Volunteer Services Coordinator</b>	NR	Natural Resources	MNR
James Christensen	<b>Assistant Wildlife Manager</b>	NR	Natural Resources	MNR
Avery Cook	<b>Upland Game Project Leader</b>	NR	Ecology	MS
Gary L. Cook	<b>Wildlife Recreation Prgm Coord</b>	NR	Fisheries & Wildlife	BS
Jason Cox	<b>Range Trend Project Leader</b>	NR	Natural Resources	MNR
Darren L. Debloois	<b>Wildlife Biologist</b>	NR	Fisheries & Wildlife	MS
Justin S. Dolling	<b>NRO Regional Supervisor</b>	NR	Fisheries & Wildlife	BS
Robert Fitts	<b>Biologist</b>	AGR	Plant Science	MS
Wayne Gustaveson	<b>Project Leader - Lake Powell</b>	NR	Fisheries & Wildlife	MS
Michael Hadley	<b>Wildlife Biologist</b>	NR	Wildlife Biologist	BS
Troy T. Hammond	<b>Conservation Officer</b>	NR	Fisheries & Wildlife	BS
Miles B. Hanberg	<b>Regional Habitat Manager</b>	NR	Fisheries & Wildlife	BS
Richard Dale Hepworth	<b>Aquatics Program Manager</b>	NR	Fisheries & Wildlife	BS
Gary Howes	<b>Assistant FES Hatchery Manager</b>	NR	Natural Resources	MNR
Bradley Hunt	<b>Hardware Ranch Manager</b>	NR	Wildlife Science	BS
Candace Hutchinson	<b>AIS Biologist</b>	NR	Natural Resources	MNR
Bruce C. Johnson Jr.	<b>Lieutenant</b>	NR	Fisheries & Wildlife	BS



Photo by Colton Finch

# Sampling of USU Alumni Working for UDWR

Name	Job Title	USU College	Major	Degree
Jason D. Jones	<b>Waterfowl Area Manager</b>	NR	Natural Resources	MNR
Daniel Keller	<b>Native Aquatics Biologist</b>	NR	Natural Resources	MNR
Kyle Kettle	<b>Predator Management Specialist</b>	Science	General Studies	Assoc
Shane Kitchen	<b>Conservation Officer</b>	NR	Wildlife Science	BS
Charles Lawrence	<b>Conservation Officer</b>	NR	Forestry	MS
David R. Lee	<b>CUP Project Leader</b>	NR	Fisheries & Wildlife	BS
Dale F. Liechty	<b>Wildlife Biologist</b>	NR	Fisheries & Wildlife	BS
Raymond Lee Loken	<b>Sergeant</b>	NR	Fisheries & Wildlife	BS
John Allen Lytle	<b>Conservation Officer</b>	NR	Fisheries & Wildlife	BS
Dax L. Mangus	<b>Wildlife Program Manager</b>	NR	Wildlife Biology	MS
Roy Marchant	<b>Wildlife Biologist</b>	NR	Fisheries & Wildlife	BS
Tory D. Mathis	<b>Wildlife Biologist</b>	Science	Biology	BS
Dean L. Mitchell	<b>R3 Initiative Coordinator</b>	NR	Fisheries & Wildlife	BS
Dustin Lee Mitchell	<b>Wildlife Biologist</b>	NR	Wildlife Biology	MS
Jonathan K. Moser	<b>Conservation Officer</b>	Science	Biology	BS
Benjamin K. Nadolski	<b>Policy Analyst</b>	NR	Fisheries Biology	MS
Casey Olsen	<b>Wildlife Specialist</b>	NR	Wildlife Specialist	BS
Daniel Olson	<b>Wildlife Migration Coordinator</b>	NR	Wildlife Biology	PhD
Weston P. Pearce	<b>Strawberry Project Biologist</b>	NR	Fisheries & Aquatics	BS
Jason D. Robinson	<b>Upland Game Biologist</b>	NR	Wildlife Biology	MS
Craig J. Schaugaard	<b>Fish Culture Coordinator</b>	NR	Aquatic Ecology	MS
Michael T. Slater	<b>Wildlife Program Manager</b>	NR	Fisheries & Wildlife	MS
Philip Kenton Tuttle	<b>Conservation Outreach Manager</b>	NR	Natural Resources	MNR
Xaela Walden	<b>Wildlife Tech II</b>	NR	Wildlife Science	BS
Guy W. Wallace	<b>Wildlife Program Manager</b>	NR	Fisheries & Wildlife	BS
Alan Ward	<b>Strawberry Project Leader</b>	NR	Fisheries & Wildlife	MS
Randy H. Wood	<b>Wildlife Program Manager</b>	NR	Fisheries & Wildlife	BS

## **SUMMARY:**

**Natural Resources 93%**

**Science 5%**

**Agriculture 2%**



Photo by Brian Maloney

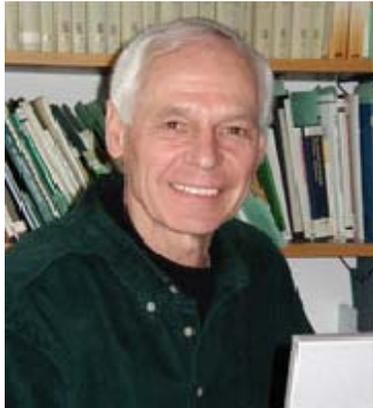
# Scientists, Staff & Graduate Students



**Phaedra Budy**  
Aquatic Research Ecologist  
Unit Leader



**Thomas Edwards**  
Landscape Research Ecologist  
Assistant Unit Leader



**John Bissonette**  
Landscape Research Ecologist  
Emeritus



**Shauna Leavitt**  
Business Assistant  
and Outreach Specialist



**Frank Howe**  
UDWR Research Liason  
USU Adjunct Faculty



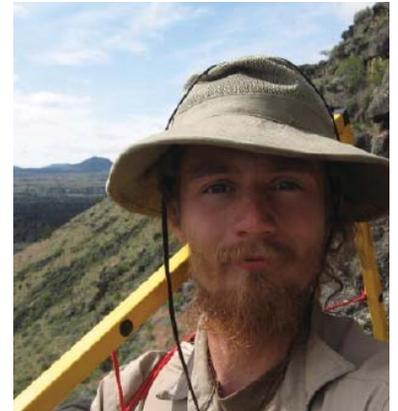
**Gary Thiede**  
Research Associate  
Watershed Sciences



**Mary Conner**  
Research Associate Professor  
Wildland Resources



**Robert Fitts**  
Research Associate  
UT Natural Heritage Program



**Jacob Gibson**  
Research Associate  
Wildland Resources



**Brian Laub**  
Research Associate  
Watershed Sciences



**Peter MacKinnon**  
Research Associate  
Watershed Sciences



**David Stoner**  
Post Doctoral Fellow  
Wildland Resources



**Mindy Wheeler**  
Research Associate  
Utah Division of Wildlife Res.



**Nick Barrett**  
Aquatic Ecology  
Ph.D. Candidate



**Demitra Blythe**  
Fisheries Biology  
Master's Candidate



# Graduate Students

continued

Photo by Gary Thiede



**Colton Finch**  
Aquatic Ecology  
Ph.D. Candidate



**Stephen Klobucar**  
Aquatic Ecology  
Ph.D. Candidate



**Bryan Maloney**  
Aquatic Ecology  
Master's Candidate



**Andrew Sims**  
Wildlife Ecology  
Master's Candidate



**Ben Stout**  
Aquatic Ecology  
Master's Candidate

# Productivity



Photo by Stephen Klobucar

## Publications

### **BISSONETTE**

#### PUBLISHED

**Bissonette, J.A.** 2017. Invited paper. Avoiding the scale-sampling problem: a consilient solution. *Journal of Wildlife Management* 81(2):192-205. (On-line 4 NOV 2016 | DOI:10.1002/jwmg.21187).

### **BUDY**

#### IN REVIEW

Dornelas, M. and **P. Budy**, (#25) and 182 others. *In review*. BioTIME: a database of biodiversity time series for the Anthropocene. Submitted 8 February 2017 to *Global Ecology and Biogeography*. USGS FSP: being handled by USGS co-author.

Klobucar, S., T.W. Rodgers, and **P. Budy**. *In review*. At the forefront: evidence of the applicability of using environmental DNA to quantify the abundance of fish populations in natural lentic waters with additional sampling considerations. Submitted 26 March 2017. *Canadian Journal of Fisheries and Aquatic Sciences: Rapid Communication*.

#### BOOK CHAPTERS

**Budy, P.**, and J. Gaeta. *In press*. Brown trout as an invader: A Synthesis of Problems and Perspectives in Western North America. Invited Chapter 12.1 in: *The Brown Trout *Salmo trutta* L.: A primer on a paradigmatic species*. Editors: Javier Lobón-Cerviá & Nuria Sanz Ball. Ilosera. Wiley. USGS FSP: IP-058204.

**Budy, P.**, K.B. Rogers, Y. Kanno, B. Penaluna, N.H. Hitt. G.P. Thiede, J. Dunham, C. Mellison, and W.L. Somer. *In press*. Distribution and Status of Trouts and Chars in

North America. Invited Chapter 8 in: *Diversity and Status of Trouts and Chars of the World*. Editors: J.L. Kershner, J.E. Williams, R.E. Gresswell. Transactions of the American Fisheries Society. USGS FSP: IP-XX.

Hansen, M., **P. Budy**, C. Guy, and T. McMahon. *In press*. Trout as Native and Invasive Species: a Management Paradox. Invited Chapter 8 in: *Diversity and Status of Trouts and Chars of the World*. Editors: J.L. Kershner, J.E. Williams, R.E. Gresswell. Transactions of the American Fisheries Society. USGS FSP: IP-XX.

#### PUBLISHED

Klobucar, S. and **P. Budy**. 2016. Consequences of seasonal variation in reservoir water level for predatory fishes: linking visual foraging and prey densities. *Canadian Journal of Fisheries and Aquatic Sciences* 73:53-6464. USGS FSP: IP-058204.

Klobucar, S.L., W.C. Saunders, and **P. Budy**. 2016. *A *Lota lota* consumption: trophic dynamics and niche space influence of invasive Burbot in a valuable sport fishery*. Transactions of the American Fisheries Society. Early On-Line. DOI: 10.1080/00028487.2016.1227372. USGS FSP: IP-074691.

Meredith, C.S., **P. Budy**, and M. Hooten. 2016. Assessing abiotic conditions influencing the longitudinal distribution of exotic brown trout in a mountain stream: a spatially-explicit modeling approach. *Biological Invasions*. DOI 10.1007/s10530-016-1322-z. USGS IP-069503.

Winters, L.K., **P. Budy**, and G.P. Thiede. 2017. Earning their stripes: the potential of tiger trout and other salmonids as biological controls of forage fishes in a western reservoir.

North American Journal of Fisheries Management 37:380-394. USGS IP-074773.

**Budy, P.**, T. Bowerman, R. Al-Chokhachy, M.M. Conner, and H. Schaller. 2017. Quantifying long-term population trends of threatened bull trout: challenges, lessons learned, and opportunities. Accepted 6 Jan 2017. Canadian Journal of Fisheries and Aquatic Sciences Early On-Line. DOI.10.1139/cjfas-2016-0336. USGS IP-066765.

Strohm, D., **P. Budy**, and T.A. Crowl. *In press*. Matching watershed and otolith chemistry to establish natal origin of an endangered desert lake sucker. Transactions of the American Fisheries Society. TAFS-2016-0040. Accepted 28 February, 2017. USGS IP-069787.

## **EDWARDS**

### IN REVIEW

**Edwards, T.C., Jr.**, J. Elith, R. Wueest, M.P. Nobis, G.G. Moisen, T.S. Frescino, J. Gibson, F. Schurr, W. Thuiller, S. Normand, Svenning, J.-C., D. Gravel, C. Merrow, and N.E. Zimmermann. *In review*. Identifying environmental and geographic characteristics of leading and trailing zones of tree species distribution tension. *Ecography*.

**Edwards, T.C., Jr.**, J. Gibson, G.G. Moisen, T.S. Frescino, A. Psomas, and N.E. Zimmermann. *In review*. Forecasting climate-induced distribution shifts for the piñon-juniper complex of the Western United States. *Global Change Biology*.

Ironside, K.E., D. Mattson, T. Theimer, B. Janson, B. Holton, T. Arundel, M. Peters, J.O. Sexton, and **T. C. Edwards, Jr.** *In review*. Quantifying animal movement: the importance of recognizing site



Photo by Bryan Maloney

recursion and foraging strategy. *Movement Ecology*.

Ironside, K.E., D. Mattson, T. Arundel, T. Theimer, B. Janson, M. Peters, **T. C. Edwards, Jr.**, and J. Hansen. *In review*. Geomorphometry in Landscape Ecology: Issues of scale, physiography, and application. *Current Landscape Ecology Reports*.

### BOOK (IN REVIEW BY PUBLISHER, FSP)

**Edwards, T. C., Jr.**, *In review*. A primer on the management and manipulation of ecological data using R. *In review*. Chapman/CRC Press, Boca Raton, Florida, USA. 129pp.

**Edwards, T. C., Jr.**, and D.R. Cutler. *In review*. Analysis of ecological data using R. Chapman/CRC Press, Boca Raton, Florida, USA. 387pp.

### PUBLISHED

Ironside, K.E., D. Mattson, D. Choate, D. Stoner, T. Arundel, J. Hansen, T. Theimer, B. Holton, B. Jansen, J.O. Sexton, K. Longshore, and **T.C. Edwards, Jr.** Variable detection rates in terrestrial global positioning system telemetry data deployed on large mammals:

probability of missing fixes. *Accepted*. *Wildlife Society Bulletin*.

Nagol, J.R., J.O. Sexton, A. Anand, R. Sahajpal, and **T.C. Edwards, Jr.** Extraction of end-member phenology by spectral unmixing. *Accepted*. *International Journal of Digital Earth*.

Stoner, D.C., J.O. Sexton, H.H. Bernalles, J.R. Nagol, and **T.C. Edwards, Jr.** 2016. Productivity of a mountain ungulate tracks phenological variability over a latitudinal gradient. *PLoS One* 11(2): e0148780.

## **Presentations**

### **BUDY**

### CONFERENCES

Stout, J.B., M. Conner, **P. Budy**, M. McKinstry, and P. MacKinnon. 2016. How do we use portable PIT-tag antenna data? 37th Annual Researcher's Meeting of the Upper Colorado River Endangered Fish Recovery Program and the San Juan River Basin Recovery Implementation Program. January 12, 2016, Durango, CO.

Laub, B.G., J. Jimenez, and **P. Budy**. 2016. An experimental habitat enhancement effort for desert rivers: San Rafael River restoration project. Tamarisk Coalition Meeting, February 9, 2016, Grand Junction, CO.

Laub, B. G., J. Jimenez, and **P. Budy**. 2016. An experimental habitat enhancement effort for Utah's desert rivers: San Rafael River restoration project. American Fisheries Society, Utah Chapter, March 17, 2016, Altamont, UT.

Stout, J.B., M. Conner, **P. Budy**, P. MacKinnon, and M. McKinstry. 2016. Improving our ability to estimate vital rates of endangered fishes

on the San Juan River using novel applications of PIT tag technology. American Fisheries Society, Utah Chapter, March 17, 2016, Altamont, UT.

Maloney, B., J. Gaeta, and **P. Budy**. 2016. Evaluating habitat-based niche requirements for the bluehead sucker (*Catostomus discobolus*): Can we identify the cause of a recruitment bottleneck? American Fisheries Society, Utah Chapter, Marcy 17, 2016, Altamont, UT.

Hafen, T., G.P. Thiede, and **P. Budy**. 2016. Temporal and spatial variation in diets of mottled sculpin in the Logan River, Utah. Poster presentation. Utah Chapter, American Fisheries Society Meeting, March 2016, Altamont, UT.

Simmons, L., S. Klobucar, and **P. Budy**. 2016. Big fish in a small pond or small fish in a small pond? Investigating arctic char dimorphism with consideration of predator-prey interactions. Utah Chapter, American Fisheries Society Meeting, March 2016, Altamont, UT.

Wright, E., G.P. Thiede, and **P. Budy**. 2016. Determining long-term trends in trout populations using standard stream electrofishing methods: Is the extra pass worth it? Poster presentation. Utah Chapter, American Fisheries Society Meeting, March 2016, Altamont, UT.

Dorathy, J., G.P. Thiede, and **P. Budy**. 2016. Two is better than one: using multiple methods to improve mottled sculpin density estimates in the Logan River, Utah. Poster presentation. Utah Chapter, American Fish-

eries Society Meeting, March 2016, Altamont, UT.

Lucas, H., B. Maloney, G.P. Thiede, and **P. Budy**. 2016. Ageing and growth of bluehead sucker in the Weber River, Utah. Poster presentation. Utah Chapter, American Fisheries Society Meeting, March 2016, Altamont, UT.

Klobucar, S.L., J.W. Gaeta and **P. Budy**. 2016. A changing menu in a changing climate? Predicting the availability of fish food in warmer arctic lakes. Annual Meeting of the Western Division of the American Fisheries Society, March 22, 2016, Reno, NV.



**Budy, P.** 2016. Arctic Lakes: Where are we in the current project? Where are we going? Arctic LTER Annual Meeting 2016, Woods Hole Marine Biological Station, April 6, 2016, Woods Hole, MA.

#### INVITED PRESENTATIONS

**Budy, P.** 2016. Towards a better understanding of factors that limit and facilitate one of the world's most invasive fishes. Invited Department Seminar, University of Wyoming, February 19, 2016, Laramie, WY.

**Budy, P.** 2016. Understanding the effects of increased drying on desert rivers and fishes: how can we avert the "perfect storm"? Honorary Speaker for 2016: Portneuf Subunit of the Idaho Chapter of the American Fisheries Society. Idaho State

University, April 28, 2016, Pocatello, ID.

Klobucar, S.L., and **P. Budy**. 2016. Consequences of seasonal variation in reservoir water level for predatory fishes: linking visual foraging and prey densities. Invited Presentation, Symposium "water Regulation and Reservoir Management in a context of global climate change". Annual Summer Meeting of the Association for the Sciences of Limnology and Oceanography, June 6, 2016, Santa Fe, NM.

**Budy, P.**, S. Klobucar, L. Winters, D. Strohm, and G.P. Thiede. 2016. Crowded reservoir trophic niche space under a warmer, drier climate. Invited Presentation, Symposium "Water Regulation and Reservoir Management in a context of global climate change". Annual Summer Meeting of the Association for the Sciences of Limnology and Oceanography, Santa Fe, NM, June 5-10, 2016.

#### EDWARDS

##### CONFERENCES

**Edwards, T.C., Jr.**, R.D. Fitts, C. Keleher, C. Bailey, J.R. Gibson, and E. Hammill. Rare plants conservation and non-renewable energy development in the Colorado Plateau of western North America: can landscape-scale models actually help? Presented paper, 2017 Annual Meeting U.S. Chapter of the Association of Landscape Ecology, Baltimore, MD, 4/10/2017.

Sims, S.A, D. Stoner, D. Koons, H. Bernales, and **T.C. Edwards, Jr.** Short-term forecasting of mule deer survival: an adaptive modelling process. Presented paper, 2017 Utah Chapter of the Wildlife Society

Annual Meeting, Bryce Canyon, Utah, 3/22/2017.

Stoner, D, J.O. Sexton, H.H. Bernales, J. Nagol, D.M. Choate, K.E. Ironside, K.M. Longshore, and **T.C. Edwards, Jr.** A statewide evaluation of mule deer abundance, cougar home range size, and predator-prey density. Presented paper, 2017 Utah Chapter of the Wildlife Society Annual Meeting, Bryce Canyon, Utah, 3/22/2017.

**Edwards, T.C., Jr.**, R.D. Fitts, C. Keleher, C. Bailey, J.R. Gibson, and E. Hammill. An optimization approach to assessing landscape-scale energy development effects on rare plant species in the Colorado Plateau of western North America. Invited paper, 82nd North American Wildlife and Natural Resources Conference, Spokane, WA, 3/6/2017.

**Edwards, T.C., Jr.**, J.R. Gibson, G.G. Moisen, T. Frescino, A. Psomos, and N.E. Zimmermann. Contraction and expansion zones in western North America piñon-juniper woodlands under projected 21st century climate change. Presented paper, 8th Biennial Conference of the International Biogeography Society, Tucson, AZ, 1/10/2017.

Gibson, J.R., **T.C. Edwards, Jr.**, G.G. Moisen, T. Frescino, A. Psomos, and N.E. Zimmermann. Contraction and expansion zones in western North America piñon-juniper woodlands under projected 21st century climate change. Presented paper, 8th Biennial Conference of the International Biogeography Society, Tucson, AZ, 1/10/2017.

Stoner, D.C., J.O. Sexton, J. Nagol, K.E. Ironside, D.M. Choate, K. Longshore, and **T.C. Edwards, Jr.** Coupling mammalian demography to climate through satellite time series of plant phenology. Invited



Photo by Colton Finch

paper, AGU Fall Meeting 2016, San Francisco, CA, 12/12/2016.

**Edwards, T.C., Jr.**, J.R. Gibson, and E. Hammill. Selecting optimal watersheds for restoration efforts in the Colorado Plateau of western North America given economies of energy development. Presented paper, 2016 Annual Meeting U.S. Chapter of the Association of Landscape Ecology, Asheville, NC, 4/5/16.

**Edwards, T.C., Jr.**, J.R. Gibson, and E. Hammill. Selecting optimal watersheds for restoration efforts in the Colorado Plateau of western North America given economies of energy development. Presented paper, 2016 Annual Meeting U.S. Chapter of the Association of

Landscape Ecology, Asheville, NC, 4/5/16.

Sims, S.A., D. Koons, D. Stoner, H. Bernales, K. Hersey, J. Nagol, J.O. Sexton, **T.C. Edwards, Jr.** Estimating mule deer demographic dynamics within Utah using an integrated modeling framework. Presented paper, 2016 Annual Meeting of the Utah Chapter of The Wildlife Society, St. George, Utah, 3/23/16.

Stoner, D.C., J.O. Sexton, D.M. Choate, J. Nagol, S.A. Sims, H.H. Bernales, K. Hersey, J. Shannon, D.J. Mattson, K.E. Ironside, K. Longshore, and **T.C. Edwards, Jr.** Mule deer abundance, cougar home range size, and predator-prey density across a productivity gradient. Presented paper, 2016 Annual Meeting of the Utah Chapter of The Wildlife Society, St. George, Utah, 3/23/2016.

Stoner, D. C., J. O. Sexton, J. Nagol, H.H. Bernales, S.A. Sims, K.E. Ironside, K. Longshore, D.M. Choate, and **T.C. Edwards, Jr.** Ecosystem responses to plant phenology across scales and trophic levels. Presented poster, 2016 Annual Meeting of the Utah Chapter of The Wildlife Society, St. George, Utah, 3/23/2016.

#### INVITED PRESENTATIONS

**Edwards, T.C., Jr.** Modelling rare plants: Issues, concerns, and resolutions to rare event sampling processes. Invited paper, Swiss Federal Research Lab WSL, Birmensdorf, Switzerland, 8/16/2016.

**Edwards, T.C., Jr.** How useful is hindcasting as a modelling approach to enhance forecast projections of species distribution models? Invited paper, Université Grenoble Alpes,

Laboratoire d'Écologie Alpine,  
Grenoble, France, 8/19/2016.

## Popular Media

### **BUDY**

#### MULTI-MEDIA

Bonneville cutthroat trout conservation video. Produced by the Quinney College of Natural Resources and also showed on UDWR Facebook page, where it reached >20,000 people on May 9: <https://www.facebook.com/UtahDWR/videos/1257954494215560/>. 2016.

#### PRINT

October 20, 2016. Gary P. Thiede, Fish Ecology Lab, Interviewed by The Herald Journal (Jeffrey DeMoss), Logan, Utah. "Stunned swimmers: electrofishing survey helps gauge health of Logan River."

### **EDWARDS**

#### RADIO

August 4, 2016. Interviewed by Leia Larsen for Ogden Standard Examiner podcast, "Out-standing in a field." <http://www.standard.net/Environment/2016/09/16/Get-out-in-the-field-with-new-Standard-Examiner-podcast.html>.

April 12, 2016. Interviewed by Daniel Kinka Utah Public Radio. "Ecologists map mule deer reproduction with NASA satellites." [<http://upr.org/post/ecologists-map-mule-deer-reproduction-nasa-satellites>].

#### PRINT

December 27, 2016. Interview with Herald Journal (Kevin Opsahl). "Sat-

ellites help track Utah's deer herds." December 27, 2016.

February 29, 2016. Interview with NASA's Earth Observatory Magazine. "Tracking Deer Habitat by Satellite." Posted online March 22, 2016 (<http://earthobservatory.nasa.gov/>).

February 8, 2016. Interview with Utah State Today (MaryAnn Muffoletto). "NASA Satellites help ecologist to map seasons, mule deer reproduction."

August 20, 2015. Interview with Ogden Standard Examiner (Leia Larsen). "Cougar plan causes uproar among conservationists."

November 11, 2014. Interview with Ogden Standard Examiner (Leia Larsen). "Understanding mountain

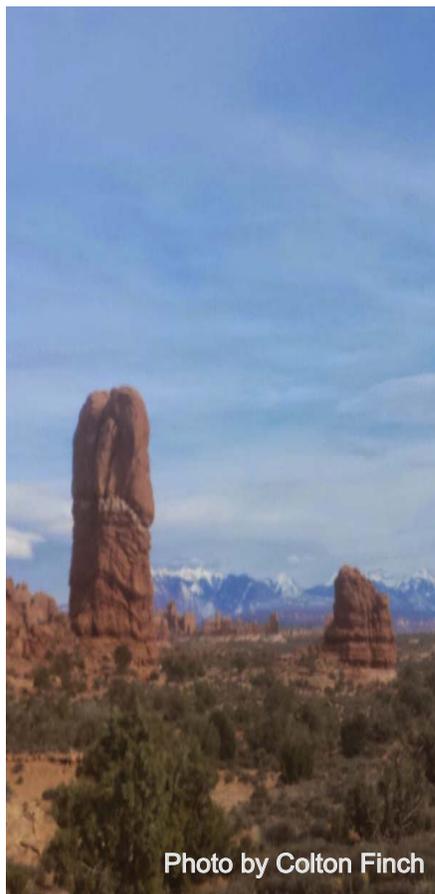


Photo by Colton Finch

lion behavior helps reduce human conflicts."

#### INTERNET

30 January 2017. Wildcat Legal Aid Conservation Society (interview with Lisa Ann Salamat). "What effect does climate change have on pumas?" <http://wcclas.org/index.php/2017/01/31/wildcat-news-brief-podcast-with-host-alex-warner-29-january-2017/>.

10 January 2017. UCAR Center for Science Education (interview with Lisa Gardiner). *Studying lions from space as climate changes.* <https://scied.ucar.edu/blog/studying-lions-space-climate-changes>.

15 December 2016. Utah State Today. *USU ecologist: how animals fare in a changing climate.* Mary-Ann Muffoletto. <http://www.usu.edu/today/index.cfm?id=56391>.

13 December 2016. *Why cougars are coming to town.* National Geographic online. Cheryl Katz. <http://news.nationalgeographic.com/2016/12/cougars-mule-deer-climate-urban-area/>

12 December 2016. *How animals will fare in a changing climate.* Press conference, Annual meeting of the American Geophysical Union, San Francisco, CA. <https://www.nasa.gov/feature/goddard/2016/how-animals-will-fare-in-a-changing-climate>.

11 February 2016. *NASA Satellites Aid USU Ecologist in Mapping Seasons, Deer Reproduction.*



Photo by Colton Finch

<http://www.usu.edu/today/index.cfm?id=55521&nl=461>

12 February 2016. *NASA Satellites Aid USU Ecologist in Mapping Seasons, Deer Reproduction.* <http://phys.org/news/2016-02-nasa-satellites-aid-ecologists-seasons.html>.

22 March 2016. *Tracking Deer by Satellite: Image of the Day.* [http://earthobservatory.nasa.gov/IOTD/view.php?id=87736&eocn=home&eo-ci=iotd\\_image](http://earthobservatory.nasa.gov/IOTD/view.php?id=87736&eocn=home&eo-ci=iotd_image)

30 March 2016. *Tracking deer by NASA Satellite.* <http://www.nasa.gov/feature/goddard/2016/track-ing-deer-by-nasa-satellite>

30 March 2016. *Tracking Deer by NASA Satellite.* <https://www.sciencedaily.com/releases/2016/03/160330184414.htm>

2 April 2016. *Researchers tap into space satellites to predict when does are due.* [http://www.oregonlive.com/today/index.ssf/2016/04/nasa\\_taps\\_into\\_space\\_satellite.html?](http://www.oregonlive.com/today/index.ssf/2016/04/nasa_taps_into_space_satellite.html?)

7 April 2016. *Tracking Deer by Satellite.* <http://wildlife.org/wild-life-conservation-from-outer-space/>.

### **LEAVITT (COOP EXTENSION AND OUTREACH)**

#### **RADIO**

March 10, 2017. "The Passion of Penstemaniacs on Wild About

Utah." <http://upr.org/post/passion-penstemaniacs-wild-about-utah>

January 26, 2017. "Orphaned Cub Rehabilitation on Wild about Utah." <http://upr.org/post/orphaned-cub-rehabilitation-wild-about-utah>

#### **INTERNET**

7 November 2016. Utah Division of Wildlife Resources - Wildlife Blog, *Bear cubs head back to the wild.* <https://wildlife.utah.gov/blog/2016/bear-cubs-head-back-to-the-wild/>

18 August 2016. Utah Division of Wildlife Resources - Wildlife Blog, *Pelicans at Strawberry Reservoir: what do they eat?* <https://wildlife.utah.gov/blog/2016/pelicans-at-strawberry-reservoir-what-do-they-eat/>

#### **PRINT**

Fall 2016. Utah State Magazine. "Leaving It to Beavers." [https://issuu.com/usuprm/docs/utah\\_state\\_magazine\\_fall\\_2016/8?e=1295814/38749813](https://issuu.com/usuprm/docs/utah_state_magazine_fall_2016/8?e=1295814/38749813)

Winter 2016. Utah State Magazine. "The Long Drive of Dreams." [https://issuu.com/usuprm/docs/utah\\_state\\_magazine\\_winter\\_2016/26?e=1295814/32474721](https://issuu.com/usuprm/docs/utah_state_magazine_winter_2016/26?e=1295814/32474721)

Summer 2016. Coop Catchup Newsletter, Issue 72, U.S. Geological Survey Fish & Wildlife Cooperative Research Unit Program. (Editor)

Spring 2017. Coop Catchup Newsletter, Issue 73, U.S. Geological Survey

Fish & Wildlife Cooperative Research Unit Program. (Editor)

## Research Grants (Active)

### **BUDY**

2016-2021. Collaborative research: an exploration of the direct and indirect effects of climatic warming on arctic lake ecosystems. Principal Investigators: **Budy, P.**, A. Giblin, B. Crump, S. Null, J. Jin. National Science Foundation: Office of Polar Programs, Total Award \$999,335.

2015-present. Assessing the State of River Science, Water Resources Management, and Water Resources Planning Tools for the Rio Grande / Rio Bravo. Principal Investigators: **P. Budy** and J. Schmidt. U.S. Geological Survey, Total Award *to date* \$131,725.

2010-present. Arctic LTER: Climate Change and Changing Disturbance Regimes in Arctic Landscapes: LAKES. Principal Investigator: **P. Budy**. National Science Foundation (NSF), UDWR, Total Award *to date* \$192,000.

2015-present. Adaptive management with and installation and development of methods and analyses for PIT tag technology and data. Principal Investigators: **P. Budy** and M. Conner. Bureau of Reclamation (DOI), Total Award \$650,000.

2013-present. Understanding the effects of wildfire on fish populations and stream geomorphology in Twitchell Canyon. Principal Investigator:

**P. Budy**. Utah Division of Wildlife Resources (UDWR) Total Award *to date* \$209,556.

2012-present. San Rafael River Restoration Science: Restoration Implementation & Monitoring, Principal Investigator: **P. Budy**. Bureau of Land Management \$684,588, Utah Division of Wildlife Resources \$26,304, Total Award *to date* \$710,892.

2015-present. Weber River, Bluehead Sucker Recruitment Bottleneck Study. Principal Investigator: **P. Budy**. Utah Division of Wildlife Resources (UDWR). Total Award *to date*: \$128,221.

2013-2016. Quantifying pelican predation potential on the fish community of Strawberry Reservoir, Utah (UDWR) and Cutthroat trout restoration (USFS- RMRS). Principal Investigator: **P. Budy**. UDWR, USFS, Total Award *to date* \$190,345.

2011-present. Evaluating cutthroat trout performance and identifying limiting factors for the native fish community of Pyramid Lake, Nevada. Principal Investigator: **P. Budy**. Utah State University, USFWS, Great Basin Cooperative Ecosystem Unit (CESU), Total Award \$394,769.

2011-present. Tributary habitat use of endangered and imperiled fishes in the Price River, Utah. Principal Investigator: **P. Budy**. Bureau of Reclamation (BOR), Activities

to Avoid Jeopardy Program, Total Award *to date* \$166,452.

2011-2015. Movement and habitat studies of endangered fishes in the Colorado River Basin. Principal Investigator: **P. Budy**. Bureau of Reclamation (BOR), Activities to Avoid Jeopardy Program, Total Award *to date* \$233,769.

2002-present. Limiting factors affecting trout population dynamics, abundance, and distribution in the Logan River, Utah: population dynamics, disease, and synergistic effects. Principal Investigator: **P. Budy**. Utah Division of Wildlife Resources, Total Award *to date* \$714,454.

2002-present. Bull trout population assessment and life-history characteristics in association with habitat quality and land use: template for recovery planning. Principal Investigator: **P. Budy**. U.S. Fish and Wildlife



Photo by Colton Finch

Service, Research Work Order, Total Award *to date* \$1,515,024.

## **EDWARDS**

2016-2021. Habitat modelling of rare plant species in the Intermountain West. Principal Investigator: **T.C. Edwards, Jr.** Bureau of Land Management, Total award \$61,300.

2016-2019. Unifying mathematical and statistical approaches for modeling animal movement and resource selection. Co-Principal Investigator: **T.C. Edwards, Jr.**



Photo by Colton Finch

National Science Foundation, Total award \$180,000.

2015-2017. learnR: Data management, manipulation, and analysis of ecological data using R. Principal Investigator: **T.C. Edwards, Jr.** USGS Ecological Survey, Total award \$51,600.

2015-2017. Distribution patterns and vegetation dynamics of forest canopy trees in the Northern Pantanal, Mato Grosso, Brasil. Principal Investigator: **T.C. Edwards, Jr.** República Federativa do Brasil, CNPq & CAPES, Total award \$46,600 (R\$175,000).

2015-2016. Weather and primary productivity mediated effects on mule deer population dynamics across a latitudinal gradient. Principal Investigator: **T.C. Edwards, Jr.** Utah

Division of Wildlife Resources, Total award \$37,400.

2014-2017. An inventory and modelling system for rare plants in the Intermountain West. Principal Investigator: **T.C. Edwards, Jr.** Bureau of Land Management, \$225,000, Utah Department of Natural Resources (ESMF funds), \$137,400, U.S. Fish and Wildlife Service, \$26,600, Total Award *to date* \$389,000.

2011-2017. Landscape-scale decision support models for the southern Rocky Mountains. Principal Investigator: **T.C. Edwards, Jr.** Bureau of Land Management, \$300,000, U.S. Fish and Wildlife Service, \$168,000, Total award \$468,000.

2011-2017. Step-down demonstration analyses of plants and animals under the BLM Rapid Ecoregional Analysis process. Principal Investigator: **T.C. Edwards, Jr.** Bureau of Land Management, Total award \$318,300.

2011-2016. Spatial responses to climate across trophic levels: monitoring and modeling plants, prey, and predators in the Intermountain Western United States. Co-Principal Investigator: **T.C. Edwards, Jr.** NASA, Total award \$533,300.

## **Graduate Students Directed**

### **BUDY**

#### **COMPLETED**

Mohn, Harrison. 2016. Improving management and conservation practices of Bonneville cutthroat trout (*Onchorhynchus clarkii utah*) through an evaluation of movement and spatial population structure. Co-

advised with Brett Roper. MS Thesis. Ecology. Utah State University

#### **IN PROGRESS**

Chapman, Kevin. In progress. Evaluating the potential direct and indirect impacts of American white pelican predation on Bonneville cutthroat trout in Strawberry Reservoir, Utah. MS Thesis. Ecology. Utah State University. *Stated date of completion: Unknown.*

Klobucar, Stephen. In progress. Understanding how arctic lake fish populations and communities are structured and function with special consideration of the potential effects of climate change. PhD Dissertation. Ecology. Utah State University. *Stated date of completion: Fall 2017.*

Finch, Colton. In progress. Fires, floods, and fish: projecting population recovery in an inland watershed. PhD Dissertation. Ecology. Utah State University. *Stated date of completion: Fall 2017.*

Maloney, Bryan. In progress. Evaluating habitat-based niche requirements for the bluehead sucker (*Catostomus discobolus*): can we identify the cause of a recruitment bottleneck? Co-advised with Jereme

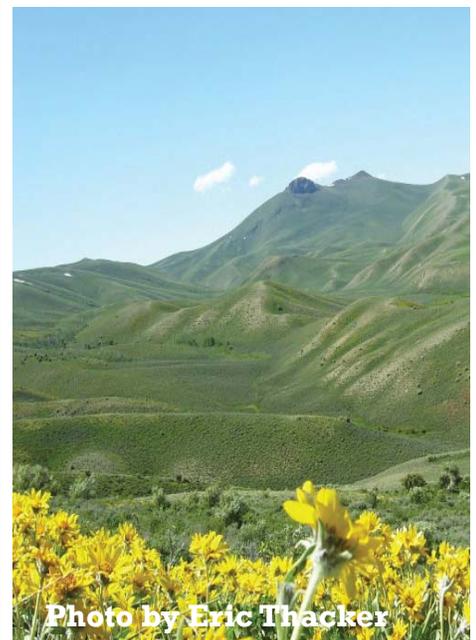


Photo by Eric Thacker

Gaeta. MS Thesis. Ecology. Utah State University. *Slated date of completion: Spring 2017.*

Stout, Ben (Jesse). In progress. Improving our ability to estimate vital rates of endangered fishes on the San Juan River using novel applications of PIT-tag technology. Co-advised with Mary Conner. MS Thesis. Ecology. Utah State University. *Slated date of completion: Spring 2018.*

Blythe, Demitra. In progress. Assessing the food web structure and ecological function relative to the historical condition of the Rio Grande in the Big Bend region. MS Thesis. Ecology. Utah State University. *Slated date of completion: Spring 2018.*

Newlon, Courtney. In progress. Identifying cues for movement and temporally-dynamic limiting factors in the bull trout movement corridor. *Slated date of completion: Spring 2017*

#### MNR GRADUATE COMMITTEE ADVISEMENT – CURRENT

Calvin Black, Utah Division of  
Wildlife Resources, Fisheries  
Reed Chaston, Utah Division of  
Wildlife Resources, Fisheries  
Michael Fiorelli, Utah Division of  
Wildlife Resources, Fisheries  
Seth Elsen, Hood Canal Enhancement  
Group, Fisheries

#### **EDWARDS**

#### IN PROGRESS

Sims, Andrew (Steven). In progress. Effects of interannual climate and primary productivity on mule deer survival and fecundity. MS Candidate.

Utah State University. *Slated date of completion: Spring 2017*

#### MNR GRADUATE COMMITTEE ADVISEMENT – CURRENT

Kari Coy, Management of *Phragmites*, Western Enviro Resources

Lindsey Washkoviak, Rare plant distribution models, U of Wyoming Nature Conservancy

### Research Associates Directed

#### **BUDY**

Thiede, Gary P. 2002 - present. Lab manager. Oversees all Fish Ecology Lab research project logistics including report writing, permitting, field and lab work, and technician supervision, and contributes intellectually to science.

MacKinnon, Peter. 2009 - present. Adaptive management with and installation and development of methods and analyses for PIT tag technology and data. Research Associate.

Laub, Brian. 2012 - present. Conservation applications for imperiled dessert fishes: identifying restoration potential of desert rivers. Post-doctoral Research Associate (*now a full time Research Scientist and Adjunct Faculty*).

Schorr, Robert. 2016 - present. Analytical assessment of the status of endangered fishes in the Upper Colorado River Basin. Research Associate.

#### **EDWARDS**

Gibson, Jacob. 2012 - present. Step-Down Analysis of Plants

and Animals under the BLM Rapid Ecoregional Analysis. Research Associate.

Stoner, David. 2011 - 2016. Spatial Responses to Climate Across Trophic Levels: Monitoring and Modeling Plants, Prey, and Predators in the Intermountain West. Post-doctoral Research Associate.

Fitts, Robert. 2011 - present. Habitat Modeling of Rare Plant Species on the Colorado Plateau. Research Associate.

Guttery, Michael. 2014 - 2015. Step-Down Analysis of Plants and Animals under the BLM Rapid Ecoregional Analysis. Post-doctoral Research Associate.

### Visiting Scholar Collaboration

#### **BUDY**

Dr. E. Becares, Dept. of Ecology, University of Leon, Spain, (2014, 2015). Limitation and facilitation of one of the world's most invasive fish: an intercontinental comparison.

Dr. G. Gonzales, Ichthios Environmental & Dpt. of Ecology, University of Leon, Spain (2015). Developing an occupancy model for native brown trout in Spain, towards a better identification of status and limiting factors.

Dr. C. LaPlanche, Ecole Nationale Supérieure d'Agronomie de Toulouse, Castanet-Tolosan, France, (2016). Forecasting the eradication success of an exotic fish from an alpine stream.

#### **EDWARDS**

Dr. Nadja Machado, Professor, Federal Institute of Mato Grosso, Graduate Program in Environmental

Physics, Instituto Federal de Mato Grosso, Campus Cuiabá - Bela Vista., BRASIL. (\*Program is Brazilian version of the U.S. Fulbright Program). Collaborative Research with T.C. Edwards: Selection of priority areas for conservation in Mato Grosso state based on ecological niche modeling, potential distribution of species and landscape structure.

## Undergraduate Research Projects Advised

### **BUDY**

Hafen, T. 2016. Temporal and spatial variation in diets of mottled sculpin in the Logan River, Utah. Poster presentation at the Utah Chapter, American Fisheries Society Meeting, March 2016, Altamont, UT.

Simmons, L. 2016. Big fish in a small pond or small fish in a small pond? Investigating arctic char dimorphism with consideration of predator-prey interactions. Oral presentation at the Utah Chapter, American Fisheries Society Meeting, March 2016, Altamont, UT. NSF Research Experience for Undergraduates



Photo by Gary Thiede

Scholar. Awarded USU URCO Research grant.

Wright, E. 2016. Determining long-term trends in trout populations using standard stream electrofishing methods: Is the extra pass worth it? Poster presentation at the Utah Chapter, American Fisheries Society Meeting, March 2016, Altamont, UT.

Dorathy, J. 2016. Two is better than one: using multiple methods to improve mottled sculpin density estimates in the Logan River, Utah. Poster presentation at the Utah Chapter, American Fisheries Society Meeting, March 2016, Altamont, UT.

Lucas, H. 2016. Ageing and growth of bluehead sucker in the Weber River, Utah. Poster presentation at the Utah Chapter, American

Fisheries Society Meeting, March 2016, Altamont, UT.

## Professional & Academic Service

### **BISSONETTE**

INVITED EXTERNAL THESIS/ DISSERTATION EXAMINER  
Reviewed Ph.D. dissertation for University of Freiburg

### REVIEWER

PloS 1 – March 2017, Human Wildlife Interactions – March 2017, Biological Conservation – September 2016 and February 2017- 2 ms, Movement Ecology – February 2017, Landscape and Urban Planning – November 2016, Wildlife Society Bulletin – August 2016, Journal of Applied Ecology – July 2016

### **BUDY**

### PEER REVIEWER FOR:

Ecosphere, Frontiers in Ecology and the Environment, Biological Conservation, Fisheries, Canadian Journal of Fisheries and Aquatic Sciences, Ecological Applications, Journal of Fish and Wildlife Management, Southwest Naturalist, Journal of Fish Biology, Ecological Applications, Transactions



Photo by Brian Maloney

of the American Fisheries Society, and North American Journal of Fisheries Management.

#### PROFESSIONAL SERVICE

Ecology of Freshwater Fish, Editor, 2015-present

#### **EDWARDS**

##### PEER REVIEWER FOR:

The Auk, Journal of Wildlife Management, Florida Field Naturalist, The Murrelet, Wilson Bulletin, Journal of Field Ornithology, Condor, Current Ornithology, Conservation Biology, Wildlife Society Bulletin, Ecology, Ecological Monographs, Remote Sensing and Environment, American Naturalist, Ecological Applications, Landscape Ecology, Ecological Modelling, Environmental Management, Biological Conservation, Journal of Vegetation Science, Trends in Ecology and Evolution, Diversity and Distributions, Ecography.

#### PROFESSIONAL SERVICE

General-Secretary, International Association for Landscape Ecology, 2009-current.

### Workshops & Training

#### **BUDY**

Fish Diversity and Conservation (WATS 3100 lecture, 3110 laboratory). Utah State University, College of Natural Resources, Watershed Sciences Department (Co-taught with J. Gaeta).

#### **EDWARDS**

WILD 6900 baseR: Management and Manipulation of Ecological Data

Using R, Spring 2016, 13 students (graduate)

WILD 6500 Biometry: Design and Analysis of Ecological Research Using R, Fall 2016, 24 students (graduate)

WILD 6900 baseR: Management and Manipulation of Ecological Data Using R, Fall 2016, 27 students (4 undergraduate, 23 graduate)

baseR: Data Management and Manipulation in R, U.S. Geological Survey, Western Geographic Science Center, Tucson, Arizona. 2/16-19/2016. 28 participants.

Integrated Projection Models (D. Koons, Lead). Quinney College of Natural Resources, Utah State University, Logan, Utah. 7/25-29/2016. 22 participants.

Population Viability Analysis (M. Connor, Lead). Utah Division of Wildlife Resources, Salt Lake City, Utah. 10/3-6/2016. 17 part g

### Honors & Recognition

#### **BUDY**

USU S.J. and Jessie E. Quinney, College of Natural Resources, Large and Notable Grant Recipient Award. Research Week Awards Gala. April 2016.

### Selected Outreach Activities

#### **BUDY**

The Native American Summer Mentorship Program- 25 Undergraduates from the Navajo Tribe. Field Trip to USU. Lab

visit to Budy Fish Ecology Lab: 1) explained the lab and structure: what do we do, fish and ecology research studies, 2) described some projects in Utah: some hands on items (pelican puke, PIT tags), and 3) described undergrad opportunities in detail: technician work, undergraduate research. 9 May 2016.



Photo by Gary Thiede

# Terrestrial Research Projects



Photo by Brian Kartchner

## Flower's Beardtongue species distribution model 2015-2016

Flower's beardtongue (*Penstemon flowersii*) is a species of concern in the Uinta Basin. Its range is limited, found in only a small area near Myton, Utah. Energy development projects surround the habitat and are now planned to commence in the known habitat area. The species grows mostly on private and tribal lands, with one small parcel on Bureau of Reclamation lands and another small plot owned by The Nature Conservancy. A petition to list Flower's beardtongue under the Endangered Species Act was rejected, but with new development, pressure to classify Flower's beardtongue as Endangered or Threatened is mounting. To aid in evaluating the proposed endangered species listing we created a species distribution model using existing location and habitat information. The model was used to explore likely locations for new occupied sites. Final model prediction accuracies were >93%.

### FUNDING

Utah DNR Endangered Species Mitigation Funds

### INVESTIGATORS and STUDENT RESEARCHERS

Robert Fitts, Research Associate

Mindy Wheeler, Research Associate

Benjamin Gibbons, Undergraduate Researcher Technician

Kristian Valles, Undergraduate Researcher Technician

### FACULTY SUPPORT

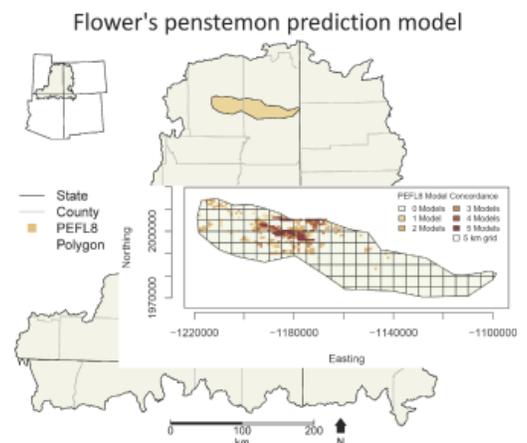
Thomas Edwards USGS, UTCFWRU, USU Wildland Resources

### PROJECT PERIOD

July 2015 – September 2016

### FIGURE CAPTION:

Spatially explicit prediction model for Flower's penstemon. Darker browns indicate high model concordance and hence greater reliability in the likelihood of plant presence.



## learnR: Data management, manipulation, and analysis of ecological data using R

The nature of analytical tools employed by University, Federal, State, Tribal and NGO researchers and scientists for analyzing ecological data has changed dramatically from commercial packages (e.g., SAS, SYSTAT) to an open source (“freeware”) environment. Central to this new approach towards analysis of ecological data is R. As a self-described statistical computing package, R rests on a core set of analytical base “packages” augmented by an extensive library of contributed analytical packages. While end-users can learn R by themselves through trial and error, experience indicates some level of base training is required to jump-start end-users. Much of this training can occur in traditional classroom settings, but the nature of R makes it amenable to distance delivery methods. This proposal will generate a set of courses in R amenable for online delivery, including through DOI Learn.

### FUNDING

U.S. Geological Survey, Office of Employee Development

### INVESTIGATORS

N/A

### FACULTY SUPPORT

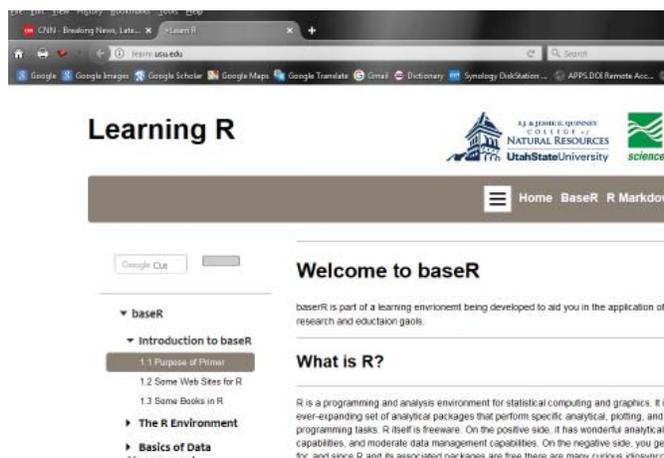
Thomas Edwards USGS, UTCFWRU, USU Wildland Resources

### PROJECT PERIOD

April 2016 – April 2018

### FIGURE CAPTION:

Web interface to learnR.



## Spatial Responses to Climate across Trophic Levels: Monitoring and Modeling Plants, Prey, and Predators in the Intermountain Western United States

We investigated the impact of climate on trophic linkages between primary productivity, herbivores, and top predators across western United States landscapes. Using the 2011 NLCD land-cover map and 14 years of MODIS NDVI composites of vegetation, we modeled land surface phenology based on geospatial climate datasets, including interpolated, remotely sensed, and topo-climatic variables derived from digital elevation models. The research fits niche-based distribution and animal movement models to remotely sensed data in order to describe the linkages between climate and ecosystems across the primary producer, herbivore, and predator trophic levels. The research has gathered time series of satellite images and coincident direct measurements of predator-prey communities over nearly a decade, as well as static soil, topography, and other geospatial data layers into a model ecosystem to inform natural resource management across the region. A total of 10 publications resulted from my project oversight. As a research group, we made 25 research presentations at professional meetings over the course of the project. In addition, we made seven presentations we describe as outreach, including portrayal of some of our collected movement information on the NASA Hyperwall.

### FUNDING

National Aeronautics and Space Administration (NASA)

### INVESTIGATORS & COOPERATORS

David Stoner, Research Associate  
Andrew Sims, Graduate Student  
USGS Southwest Biological Science Center, Flagstaff  
USGS Western Science Center, Las Vegas  
University of Maryland, Global Land Cover Facility

### FACULTY SUPPORT

Thomas Edwards, USGS, UTCFWRU, USU Wildland Resources

### PROJECT PERIOD

September 2011 – July 2016

**FIGURE CAPTION:** Example of detection issues related to denning sites used by a radio-collared cougar. Ironside et al. In press, Wildlife Society Bulletin



## Step-down demo analysis of plants and animals under the BLM Rapid Ecoregional Analysis Process

Three combined efforts serve as a step-down demonstration analysis of the Bureau of Land Management's (BLM) Rapid Ecoregional Assessment (REA) process which is currently being implemented across BLM-owned and managed lands. These include (i) quantitative assessments of a Gunnison sage-grouse bioclimatic model, and map products of projected grouse distributions and habitat under climate and land-use change scenarios; (ii) optimization models for identifying watersheds of highest restoration potential, targeting aspen habitat as an example; (iii) use of REA-based datasets on an independent project funded from other sources (i.e., rare plants and energy development); and (iv) development of a set of workshops on how REA data can be used by field managers. The workshops are designed to inform BLM land managers on how the REA databases can be used for current management issues of concern to BLM, and what additional site-specific data may need to be gathered and where.

### FUNDING

Bureau of Land Management

### INVESTIGATORS

Jacob Gibson, Research Associate

### FACULTY SUPPORT

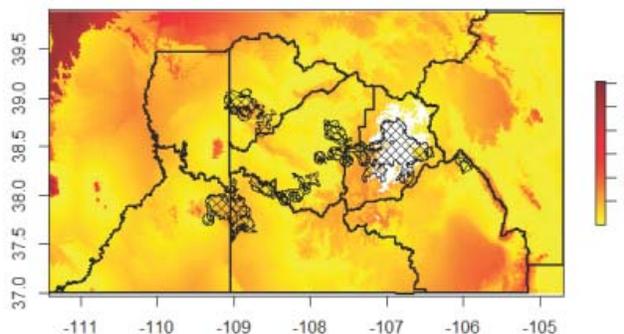
Thomas Edwards, USGS, UTCFWRU, USU Wildland Resources

David Koons, USU Wildland Resources  
Edd Hammill, USU Watershed Sciences

### PROJECT PERIOD

August 2012 – July 2017

**FIGURE CAPTION:** Spatially explicit depiction of change in selected climate variable. "More red" indicates higher rate of change in an area. Note Gunnison Basin (white). Indicates a rate of change outside the norms of the region.



## Utah threatened and endangered plant inventory: Modelling rare plant species distributions in the context of multiple-use land management

Utah is the home of approximately 340 endemic plant taxa. Many of these are considered species of concern at both State and Federal levels, with the U.S. Fish and Wildlife Service having responsibility for reviewing the species of concern for possible listing under the Endangered Species Act. Of special interest are identifying, mapping, and modelling known and possible locations of the species on public lands. The botany element of the Utah Natural Heritage Program, now housed in the Quinney College of Natural Resources, Utah State University, will survey for plants considered for review by the Fish and Wildlife Service, along with other species where little information is available. Species distribution models will be built for each species and analyzed in the context of ongoing management issues on public lands, especially energy development.

### FUNDING

Bureau of Land Management  
Utah DNR

### INVESTIGATORS

Robert Fitts, Research Associate  
Mindy Wheeler, Research Associate  
Benjamin Gibbons, Undergraduate Research Technician  
Kristian Valles, Undergraduate Research Technician

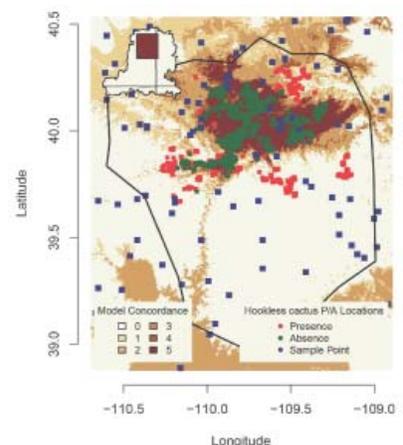
### FACULTY SUPPORT

Thomas Edwards, USGS, UTCFWRU, USU Wildland Resources  
Edd Hammill, USU Watershed Sciences

### PROJECT PERIOD

October 2012 – September 2017

**FIGURE CAPTION:** Predicted distribution of the hookless cactus (darker brown, higher presence likelihood) in relation to known presence (green) and absence (red). Blue are random field sample test locations.



## Weather and primary productivity mediated effects on mule deer population dynamics across a latitude

This research increases understanding of how climate influences deer demographic rates in Utah, and how these rates may change in the future. The objectives of this study are to: (i) model and project deer survival and fecundity for a range of environmental conditions at the wildlife management unit (WMU) level; (ii) identify WMU's where deer productivity and survival is most likely to change due to variation in weather and NDVI; and (iii) examine current deer survival rates and determine if they are truly representative of the surrounding units. By combining NDVI and climatic variable data, we will be able to determine how WMU's differ and be able to evaluate if Utah Division of Wildlife Resources (DWR) is monitoring survival on the appropriate units. Additionally, the results will inform DWR as to which deer units are over or underperforming and how this will likely change with changing climate.

### FUNDING

Utah Division of Wildlife Resources (match to NASA funding)

### INVESTIGATORS

Andrew Sims, M.S. Graduate Student

### FACULTY SUPPORT

Thomas Edwards, USGS, UTCFWRU, USU Wildland Resources

David Koons, USU Wildland Resources

### PROJECT PERIOD

August 2014 – December 2016

**FIGURE CAPTION:** Adaptive forecasting example. Top figure is initial forecast: note it over predicts. Data from two months into the year (middle figure) improves forecast of juveniles, but it requires six months into year to improve forecast for adults.

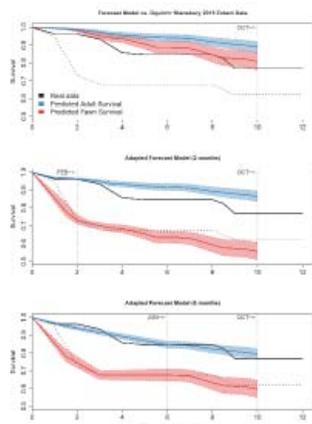


Photo by Karin Kettinring

## Habitat modeling of rare plant species in the Intermountain West

This project increases knowledge on rare plants in the Intermountain West by continuing to (i) implement sampling, data organization, and modelling protocols developed previously, with an expansion outside of the extent of the Colorado Plateau; (ii) expand modelling efforts to now include abundance estimates, and species-specific occupancy estimates, where data density is sufficient; and (iii) begin development of a more encompassing data structure amenable to BLM REA Data Portal. The Utah Natural Heritage Program will continue to provide detailed GPS based locations of sensitive species, along with abundance measures of individual plants at sample locations. This information will update older reports of the species using hand drawn maps of plant clusters and rough estimates of numbers of individuals. The information gathered at negative (i.e., true absence) points will be used to better define the habitat of the sensitive species, and help in future surveys for rare plants. Collection of these data is part of a longer-term strategy to survey these species and obtain sufficient data for spatial modelling efforts.

### FUNDING

Bureau of Land Management

### INVESTIGATORS

Robert Fitts, Research Associate

Mindy Wheeler, Research Associate

Benjamin Gibbons, Undergraduate Research Technician

Kristian Valles, Undergraduate Research Technician

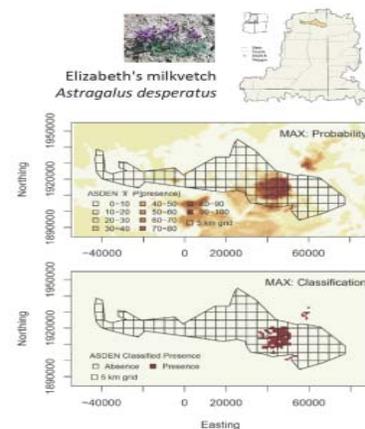
### FACULTY SUPPORT

Thomas Edwards, USGS, UTCFWRU, USU Wildland Resources

### PROJECT PERIOD

October 2012 – September 2017

**FIGURE CAPTION:** Spatially explicit prediction model for Elizabeth's milkvetch.



# Aquatic Research Projects



Photo by Karin Kettenring

## Improving our ability to estimate vital rates of endangered fishes on the San Juan River using novel applications of PIT tag technology

Accurate estimates of vital rates are essential for tracking and understanding the successful recovery of endangered species such as the razorback sucker and the Colorado pikeminnow. Mobile Passive Integrated Transponder (PIT) tag antenna systems (e.g., on a floating raft) have recently been developed to increase resight rates; however, mobile systems present new challenges. Tags, not fish, are detected thus increasing the chance that shed tags or dead fish with tags are being detected which could lead to over-estimation of survival. Our goal is to address this limitation and determine if the addition of mobile detections can improve vital rate estimates. Our field work concentrates on 273 kilometers of San Juan River designated critical habitat. PIT tags were seeded in the river to quantify dead/shed tag movement. Live fish movements were identified by matching tag detections with live capture data. Preliminary results suggest that even dead tags move much greater distances than initially thought. This method may be useful in censoring data and increasing fish resighting numbers, which will improve the accuracy and precision of estimates of vital rates, while also providing new information about post stocking location and habitat associations.

### FUNDING

U.S. Bureau of Reclamation

### INVESTIGATOR

Ben Stout, M.S. Candidate

### FACULTY SUPPORT

Phaedra Budy, USGS UTCFWRU, USU Watershed Sciences, Ecology Center

Mary Conner, USU Wildland Resources, Ecology Center

### PROJECT PERIOD

June 2015 – December 2017



## Evidence of the applicability of using environmental DNA to quantify the abundance of fish populations in natural lentic waters with additional sampling considerations

In the Arctic, we are using a multifaceted approach combining field observations, experiments, and modeling techniques to improve our understanding of lake ecosystems in a changing climate. In one component, we investigated the relationship between eDNA concentration and arctic char (*Salvelinus alpinus*) abundance in five natural lakes, and additionally, we examined the effects of different temporal (e.g., season) and spatial (e.g., site, depth) scales on eDNA concentration. Concentrations of eDNA were linearly correlated with fish abundance ( $R^2 = 0.82$ ) and exponentially correlated with density ( $R^2 = 0.97$  by area;  $0.85$  by volume). Across lakes, eDNA concentrations were greater and more homogeneous in the water column during mixis; however, when stratified, eDNA concentrations were greater in the hypolimnion. Overall, our findings demonstrate that eDNA techniques can produce effective estimates of relative fish abundance in natural lakes. These findings can guide future research and management of important fish populations (e.g., conservation, subsistence resources) in a changing climate using rapid and minimally invasive sampling.

### FUNDING

National Science Foundation  
Ecology Center, Utah State University  
U.S. Geological Survey - UCFWRU (*in-kind*)

### INVESTIGATORS

Stephen Klobucar, PhD Candidate  
Tyler Arnold, Undergraduate Researcher

### FACULTY SUPPORT

Phaedra Budy, USGS-UTCFWRU, USU Watershed Sciences, Ecology Center

### PROJECT PERIOD

October 2010– February 2022



## Twitchell Fire Research: Habitat-based predictions of cutthroat trout biomass in burned streams

Post-fire debris flows and channel reorganization often create visually dramatic habitat alterations. However, habitat quality for salmonids is an aggregate of physical conditions and the limiting factor in burned watersheds may not be visually apparent. Our objective was to identify habitat characteristics that predict trout biomass between burned and unburned watersheds. We measured numerous habitat attributes and used a linear mixed-effects model to determine the best predictor of Bonneville cutthroat trout biomass. Percent canopy cover is the best predictor of cutthroat biomass, with water depth as the second best predictor and year and stream as random effects. Our quantitative descriptions of the relationship between habitat and biomass can improve the efficiency of habitat restoration and improve our understanding of the population viability and ecology of these culturally and economically important fishes.

### FUNDING

Quinney College of NR, PhD Fellowship  
U.S. Forest Service  
Utah Division of Wildlife Resources  
USU Ecology Center  
Utah U.S. Geological Survey-UCFWRU (*in-kind*)

### INVESTIGATORS

Colton Finch, PhD Candidate

### FACULTY SUPPORT

Phaedra Budy, USGS, UTCFWRU, USU Watershed Sciences, Ecology Center  
Patrick Belmont, USU Watershed Sciences  
Brett Roper, FS & USU Watershed Sciences  
Sarah Null, USU Watershed Resources  
Nancy Huntly, USU Ecology Center

### PROJECT PERIOD

August 2013 - August 2017



## Evaluating habitat-based niche requirements for imperiled bluehead sucker (*Catostomus discobolus*); identifying potential recruitment bottlenecks

Bluehead sucker (BHS; *Catostomus discobolus*) now occupy only 47% of their historic range, and the genetically-distinct Weber River (N. UT) population is experiencing a likely recruitment bottleneck. The many dams and diversions altering fish habitat and flow and thermal regimes in the Weber River may contribute to the recruitment bottleneck. Our objectives were to determine whether spawning and rearing habitat available in the river is limiting BHS recruitment. We used reach-based surveys to locate and quantify spawning habitat and we sampled backwaters near spawning reaches to evaluate rearing habitat. We conducted laboratory experiments to determine optimal temperatures and velocities for juvenile growth. Availability of pools, gravels, and cobbles were important components of spawning habitat. Juvenile sucker abundance increased significantly with depth of backwaters, and juvenile growth was greatest in cooler temperature and slower velocity treatments. Collectively, these results suggest BHS recruitment may be limited by availability of small, rocky substrate and pools for spawning and deep, slow backwaters at the optimal temperature for rearing. By evaluating factors that may limit BHS recruitment, this study will provide a template for future restoration efforts directed at recovering this imperiled population.

### FUNDING

Utah Division of Wildlife Resources, City of Ogden, Davis and Weber Counties Canal Company, PacifiCorp, Provo River Water Users Association, Trout Unlimited, US Department of the Interior – Bureau of Reclamation, Weber Basin Water Conservancy District, Weber River Water Users Association, USU Ecology Center, US Geological Survey – UTCFWRU (in kind)

### INVESTIGATORS

Bryan Maloney, M.S. Candidate

### FACULTY SUPPORT

Phaedra Budy, USGS, UTCFWRU, USU Watershed Sciences  
Jereme Gaeta, USU Watershed Sciences, Ecology Center

### PROJECT PERIOD

April 2015 – April 2017



## Factors affecting fish population dynamics, abundance, and distribution: Logan River trout viability and long-term monitoring

A majority of cutthroat trout populations are imperiled or extinct due to habitat degradation and exotic species. To quantify abundance and vital rates and evaluate trends, we selected a large population of Bonneville cutthroat trout from the Logan River, Utah, a river consisting of high-quality, connected habitat. Over the past 16 years, we have completed a comprehensive population assessment, including abundance estimates and a mark-recapture study of site fidelity, growth, and survival. Abundance of cutthroat trout varied greatly by sample site, ranging from 38 fish/km at lower elevations up to 822 fish/m at higher elevations. Population trend ( $\lambda$ ) of cutthroat trout estimated for this entire population based on pooled site abundance estimates was 0.89 (0.77 – 1.02), indicating an apparent overall decline; however, confidence intervals overlapped  $\lambda = 1$  and site-specific population trends are highly variable. The new population of cutthroat trout restored to the Right Hand Fork tributary continues to increase (now 420 fish/km) and adults are now up to 320 mm long. Our results provide important conservation and recovery benchmarks for identifying rangewide limiting factors of native cutthroat trout.

### FUNDING

U.S. Forest Service  
U.S. Geological Survey–UCFWRU (in-kind),  
Utah Division of Wildlife Resources (UDWR)  
UDWR Dedicated Hunter Program  
Trout Unlimited and others.

### INVESTIGATORS

Gary P. Thiede, Research Associate  
Thomas Hafen, Undergraduate Technician  
Justin Dorathy, Undergraduate Technician  
Kendra Nichols, Undergraduate Technician  
Ethan Reynolds, Undergraduate Technician  
Brad Winger, Undergraduate Technician

### FACULTY SUPPORT

Phaedra Budy, USGS, UTCFWRU, USU-Watershed Sciences,  
Ecology Center

### PROJECT PERIOD

2001- 2016 (on-going)



## **Assessment of the ecological structure and function of the Rio Grande River in Big Bend N.P., Texas**

My project involves understanding how the aquatic ecology, with an emphasis on the native fish community, has been impacted by the modern flow and sediment regimes of the Rio Grande River. From the data I have collected thus far, I found fish diversity was higher in canyon sites than the alluvial valley sites of the river. The fish community also tended to be more diverse at sites I considered more complex in terms of in-channel mesohabitat types. For the upcoming year, I plan to complete my field sampling in Big Bend NP, and begin stable isotope analyses to reconstruct the aquatic food web of the Rio Grande. Reconstructing the food web will allow me to identify any critical limiting factors associated with the native fish diversity of the Rio Grande. My work will contribute to the ecological understanding of the Rio Grande River, and contribute to potential management goals aimed at sustaining the aquatic and physical integrity of this desert river.

### **FUNDING**

National Park Service  
USGS Climate Science Center

### **INVESTIGATORS**

Demitra Blythe, M.S. Candidate  
Todd Blythe, M.S. Candidate  
Brian Laub, Assistant Professor

### **FACULTY SUPPORT**

Phaedra Budy, USGS, UTCFRU, USU-Watershed Sciences, Ecology Center  
Jack Schmidt, USU Watershed Sciences  
Janice Brahney, USU Watershed Sciences

### **PROJECT PERIOD**

January 2016 - May 2018

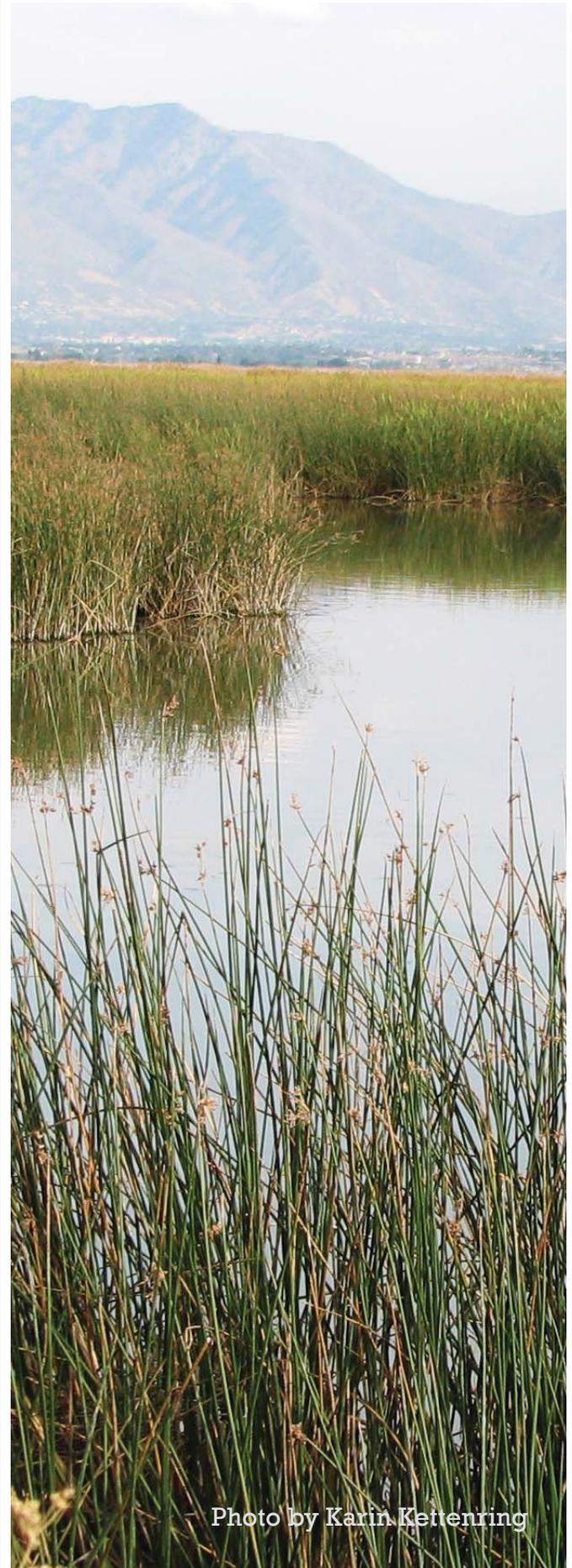


Photo by Karin Kettingring

## LOCAL KNOWLEDGE - LOCAL SOLUTIONS, CONT.

working group (LWG) process throughout Utah to begin addressing localized threats to sage-grouse (*Centrocercus* spp.) and sagebrush obligate species that inhabit Utah. Over time, this process has enhanced communications and collaboration among private stakeholders, local, regional and state governments, and state and federal management agencies and mitigated regional and state-wide conservation threats to sage-grouse and other sagebrush obligate species. The first LWGs met 8 years before environmental organizations petitioned the U.S. Fish and Wildlife Service (USFWS) to list the sage-grouse as endangered under the federal Endangered Species Act (ESA).

In March 2010, the USFWS designated greater sage-grouse (*C. urophasianus*) as a candidate species for ESA protection. Their decision was based on continued habitat fragmentation and inadequate regulatory mechanisms at the local, state, and federal levels to curtail the impacts. Because sage-grouse are landscape species that inhabit lands owned and managed by multiple jurisdictions, the preservation of large tracts of suitable habitat and the management of these areas to maintain connectivity between populations will be paramount to their conservation. Listing of the sage-grouse for protection under the ESA would limit state management authority and impact local, state and regional economies.

Within Utah, Governor Gary H. Herbert chartered a Task Force to develop recommendations for a statewide plan for the conservation of sage-grouse and provide for the continued economic health of the state. In 2013, the Conservation of Greater Sage-grouse in Utah (Plan) was published. The Plan would not have been possible without the two decades of research and community involvement accomplished by CBCP. In February 2015, Governor Herbert signed an Executive Order (EO) to fully implement the Plan. The EO recognized and credited the CBCP and the LWGs for conducting the baseline research and community involvement essential to building the Plan. Because the LWGs' efforts, the state of Utah possessed unparalleled knowledge about the factors essential to the species conservation. The LWG Plans were aggregated into a statewide plan for sage-grouse. The collective result provided an organized approach for addressing the factors used by the USFWS to measure the success of conservation actions.

Utah's LWGs clearly demonstrated the importance of the knowledge and values of local communities, those communities often most affected by conservation policies, in developing sound conservation policies. This local knowledge is increasingly being sought and acknowledged by federal and state agencies and non-governmental organizations because of their valuable contributions to natural resources conservation and management. The success of these relationships has been linked to reciprocity and transparency in information exchange, common goals, enhanced understanding of rules of law and social processes, and shared scientific discovery, which collectively created a foundation for mutual trust. These social engagement processes, often referred to as local working groups, are enhancing the connectedness of communities to government and shaping individual and group action leading to increased ownership and positive outcomes. Through these processes, innovation, new ideas, and risk taking are encouraged. However, even given innovative successes, there remain practical and policy challenges and unresolved questions regarding how governments view and respond to communities empowered to make their own decisions.

To shed some light on these unresolved questions, Utah State University Extension, Utah Public Lands Policy Coordination Office, Utah Department of Natural Resources, and Utah Division of Wildlife Resources are hosting a symposium from 8-12 AM Wednesday, February 1, 2017, at the 70th Annual Meeting of the Society for Range Management. The symposium will be held in St. George, Utah (Ballroom F of the Dixie Conference Center, 1835 S Convention Center Dr.; there is a registration fee). The symposium will feature case studies that explore the range of community involvement in natural resources conservation decision-making.



For more information about the program go visit the CBCP website at [www.utahcbcp.org](http://www.utahcbcp.org).

Photo by Photo courtesy of Todd Black.



**We wish you all safe  
and successful research this  
coming year!**