Commemorating our 80th year of Service

Established in 1935

IN COOPERATION WITH:

USGS science for a changing world

Utah DNR Wildlife Resources

S.J. & Jessie E. Quinney College of Natural Resources, Utah State University

U.S. Fish & Wildlife Service

Wildlife Management Institute, Washington, D.C.

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

Annual Report 2014-2015

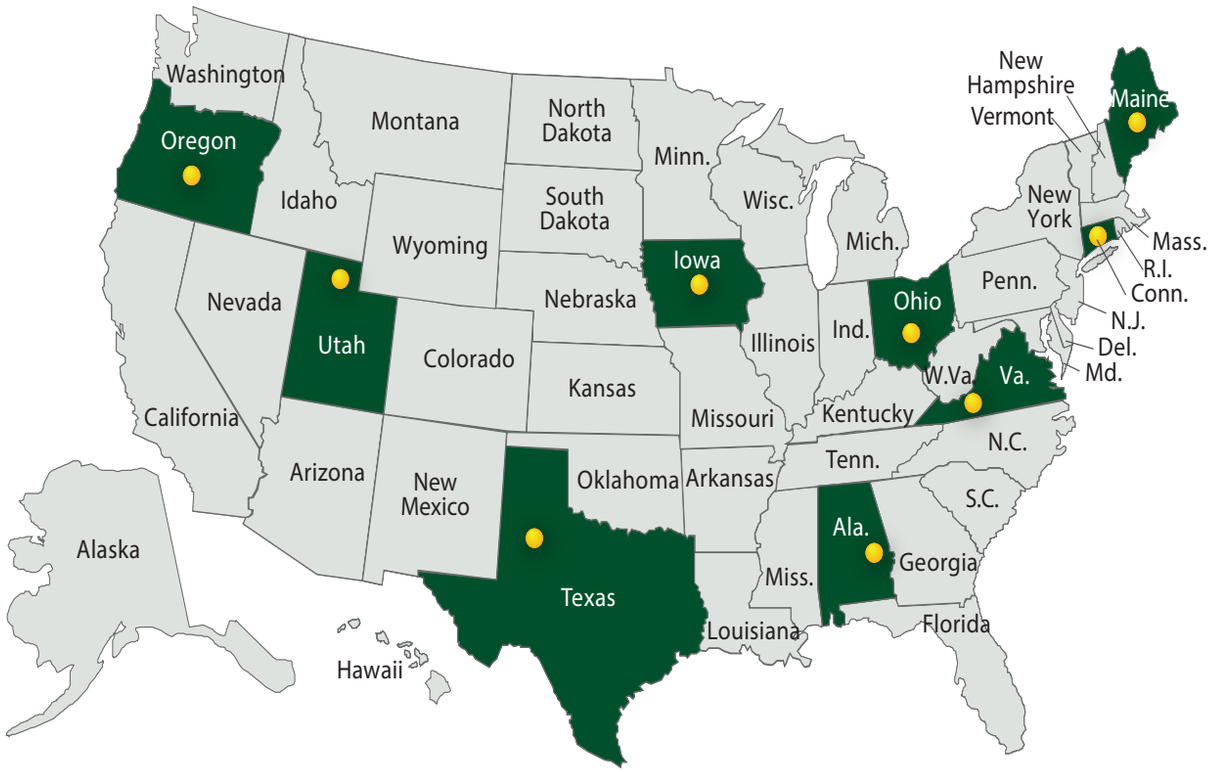
U.S. Geological Survey, Utah Cooperative Fish & Wildlife Research Unit

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

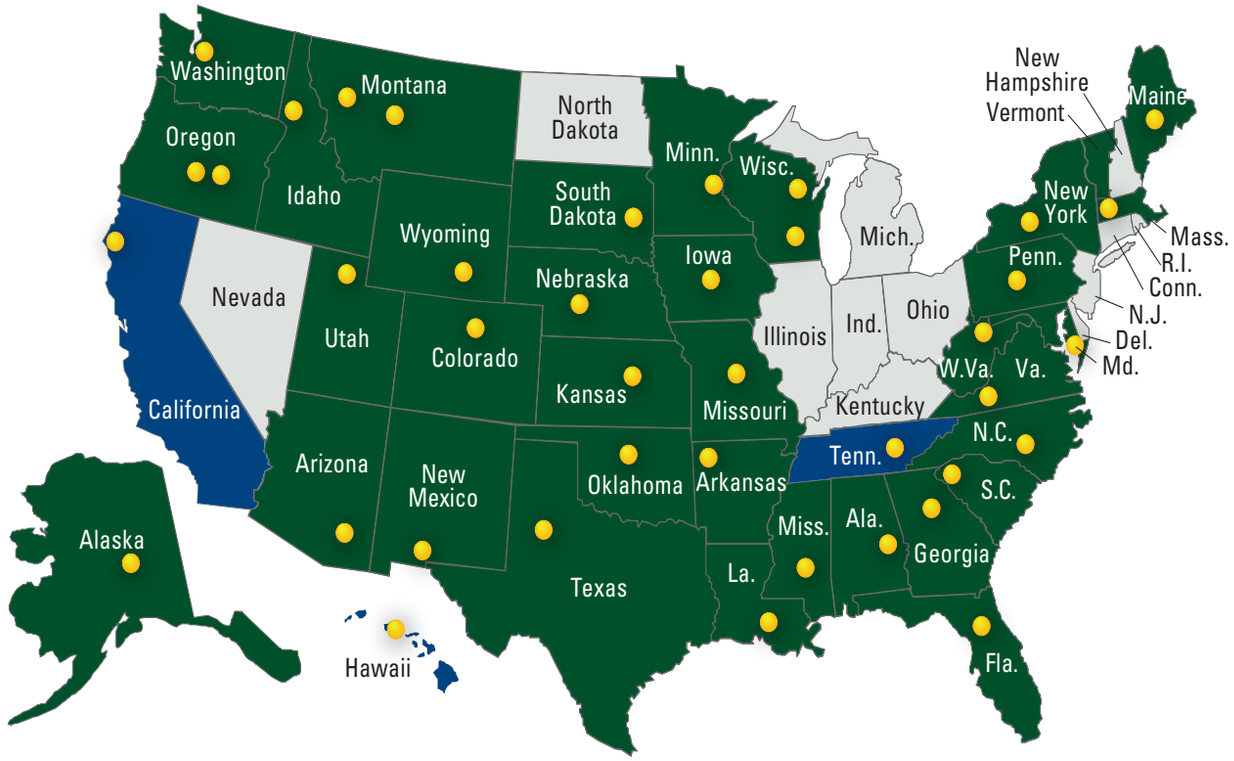
The Cooperative Fish and Wildlife Research Units date back to 1932 when J.N. "Ding" Darling invested $3,000 to establish the first Unit in Iowa. This investment was in response to reading a report prepared by Aldo Leopold and 14 other prominent conservationists. This influential report boldly stated 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 Unit States including Alaska and Hawaii.

Cover Photo by Colton Finch
Green River at Swasey's Beach, Utah



1935: First 9 Units



2015: 40 Current Units

Mission Statement
Utah Cooperative Fish and Wildlife Reserach UDWR - Utah

In 2015, the Utah Cooperative Fish and Wildlife Research Unit celebrates its **80th 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 though excellence in research, instruction, and interaction with cooperators.

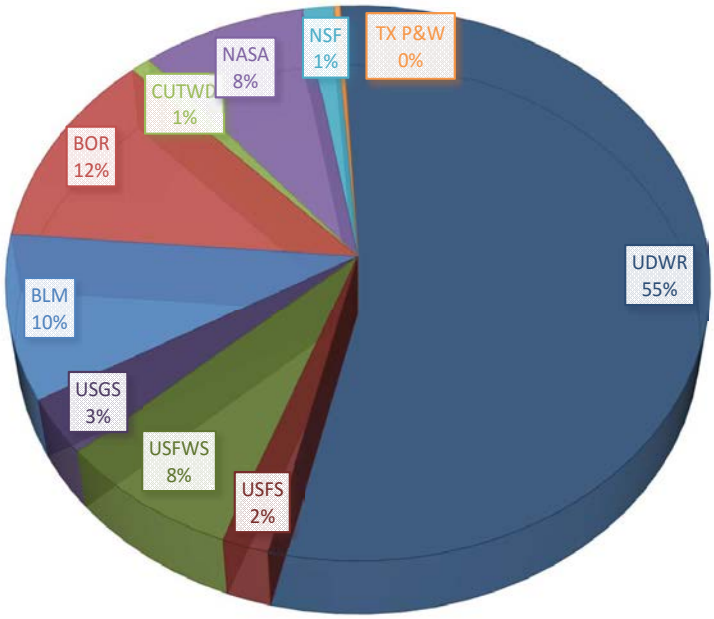
Research expertise of the Unit staff includes: landscape ecology, conservation biology, research design and applied statistics, larger scale animal dynamics, geographical information system and habitat restoration methodology, terrestrial and aquatic habitat analysis, population management and assessment, 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

2015 Research Contracts & Grants
Funding Summary by Source



UDWR - Utah Division of Wildlife Resources
USFS - U.S. Forest Service
USFWS - U.S. Fish and Wildlife Service
USGS - U.S. Geological Survey
BLM - Bureau of Land Management
BOR - Bureau of Reclamation
CUTWD - Central Utah Water Conservancy District
NASA - National Aeronautics and Space Administration
NSF - National Science Foundation
TX P&W - Texas Parks and Wildlife Department (0.3%)


Photo by Frank Howe

Sampling of USU Alumni Working for UDWR

Name	Job Title	USU College	Major	Degree
J.D. Abbott	**Wildlife Conservation Officer**	NR	Fisheries & Aquatics	BS
Paul Vincent Badame	**Wildlife Coordinator**	NR	Fisheries & Wildlife	BS
Dan Barnhurst	**Sergeant/Conservation Officer**	NR	Fisheries & Wildlife	MS
J. William (Bill) Bates	**Wildlife Section Chief**	NR	Fisheries & Wildlife	MS
Thomas W. Becker	**Wildlife Biologist**	NR	Fisheries & Wildlife	BS
Heather Hill Bernales	**Wildlife Biologist**	NR	Wildlife Biology	MS
David L. Beveridge	**Lieutenant**	NR	Fisheries & Wildlife	BS
Gary John Bezzant	**Regional Habitat Manager**	NR	Human Resources	MS
Garn J. Birchell	**Wildlife Biologist**	NR	Fisheries & Wildlife	MS
Calvin M. Black	**Asst Aquatics Program Manager**	NR	Fisheries & Wildlife	BS
Natalie Boren	**Biologist**	NR	Natural Resources	BS
Quentin Bradwisch	**Native Fish Biologist**	NR	Fisheries & Wildlife	BS
Matthew G. Briggs	**Sergeant**	NR	Fisheries & Wildlife	BS
Michael F. Canning	**Assistant Director**	NR	Aquatic Ecology	MS
Torrey Christophersen	**Lieutenant**	NR	Fisheries & Wildlife	BS
Avery Cook	**Upland Game Project Leader**	NR	Ecology	MS
Gary L. Cook	**Wildlife Recreation Prgm Coord**	NR	Fisheries & Wildlife	BS
Darren L. Debloois	**Wildlife Biologist**	NR	Fisheries & Wildlife	MS
Justin S. Dolling	**NRO Regional Supervisor**	NR	Fisheries & Wildlife	BS
John A. Fairchild	**CRU Regional Supervisor**	NR	Fisheries & Wildlife	BS
Robert Fitts	**Biologist**	AGR	Plant Science	MS
Wayne Gustaveson	**Project Leader - Lake Powell**	NR	Fisheries & Wildlife	MS
Michael Hadley	**Wildlife Biologist**	NR	Wildlife Biologist	BS
Troy T. Hammond	**Conservation Officer**	NR	Fisheries & Wildlife	BS
Miles B. Hanberg	**Regional Habitat Manager**	NR	Fisheries & Wildlife	BS
Richard Dale Hepworth	**Aquatics Program Manager**	NR	Fisheries & Wildlife	BS
Bradley Hunt	**Hardware Ranch Manager**	NR	Wildlife Science	BS

Sampling of USU Alumni Working for UDWR

Name	Job Title	USU College	Major	Degree
Bruce C. Johnson Jr.	**Lieutenant**	NR	Fisheries & Wildlife	BS
Kyle Kettle	**Predator Management Specialist**	Science	General Studies	Assoc
Charles Lawrence	**Conservation Officer**	NR	Forestry	MS
David R. Lee	**CUP Project Leader**	NR	Fisheries & Wildlife	BS
Dale F. Liechty	**Wildlife Biologist**	NR	Fisheries & Wildlife	BS
Raymond Lee Loken	**Sergeant**	NR	Fisheries & Wildlife	BS
John Allen Lytle	**Conservation Officer**	NR	Fisheries & Wildlife	BS
Dax L. Mangus	**Wildlife Program Manager**	NR	Wildlife Biology	MS
Roy Marchant	**Wildlife Biologist**	NR	Fisheries & Wildlife	BS
Tory D. Mathis	**Wildlife Biologist**	Science	Biology	BS
Dean L. Mitchell	**Outreach Section Chief**	NR	Fisheries & Wildlife	BS
Dustin Lee Mitchell	**Wildlife Biologist**	NR	Wildlife Biology	MS
Jonathan K. Moser	**Conservation Officer**	Science	Biology	BS
Benjamin K. Nadolski	**Policy Analyst**	NR	Fisheries Biology	MS
Casey Olsen	**Wildlife Specialist**	NR	Wildlife Specialist	BS
Weston P. Pearce	**Wildlife Specialist**	NR	Fisheries & Aquatics	BS
Michael R. Roach	**Conservation Officer**	NR	Recreation Resources	BS
Jason D. Robinson	**Upland Game Biologist**	NR	Wildlife Biology	MS
John Salevurakis	**Biologist**	NR	Fisheries Management	BS
Craig J. Schaugaard	**Fish Culture Coordinator**	NR	Aquatic Ecology	MS
Michael T. Slater	**Wildlife Program Manager**	NR	Fisheries & Wildlife	MS
Philip Kenton Tuttle	**Native Aquatics Biologist**	NR	Natural Resources	MS
Guy W. Wallace	**Wildlife Program Manager**	NR	Fisheries & Wildlife	BS
Alan Ward	**Strawberry Project Leader**	NR	Fisheries & Wildlife	MS
Roger B. Wilson	**Aquatics Section Chief**	NR	Fisheries & Wildlife	BS
Randy H. Wood	**Wildlife Program Manager**	NR	Fisheries & Wildlife	BS

SUMMARY:

Natural Resources 92%

Science 6%

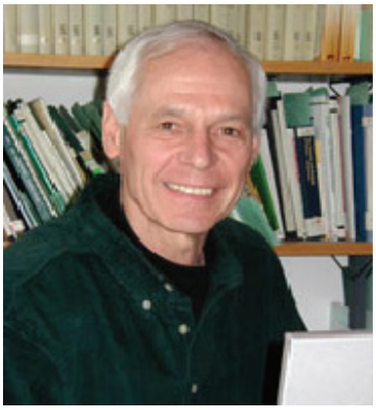
Agriculture 2%

Scientists


Photo by Colton Finch

Phaedra Budy
Aquatic Research Ecologist
Unit Leader

Thomas Edwards
Landscape Research Ecologist



John Bissonette
Landscape Research Ecologist
Emeritus

Frank Howe
UDWR Research Liason
USU Adjunct Faculty

Gary Thiede
Research Associate
Watershed Sciences

Brian Laub
Research Associate
Watershed Sciences

Graduate Students

Robert Fitts
Research Associate
UT Natural Heritage Program

Demitra Blythe
Fisheries Biology
Master's Candidate

Jacob Gibson
Research Associate
Wildland Resources

Kevin Chapman
Aquatic Ecology
Master's Candidate

David Stoner
Post Doctoral Fellow
Wildland Resources

Colton Finch
Aquatic Ecology
Ph.D. Candidate

Photo by Stephen Klobucar

Graduate Students

continued

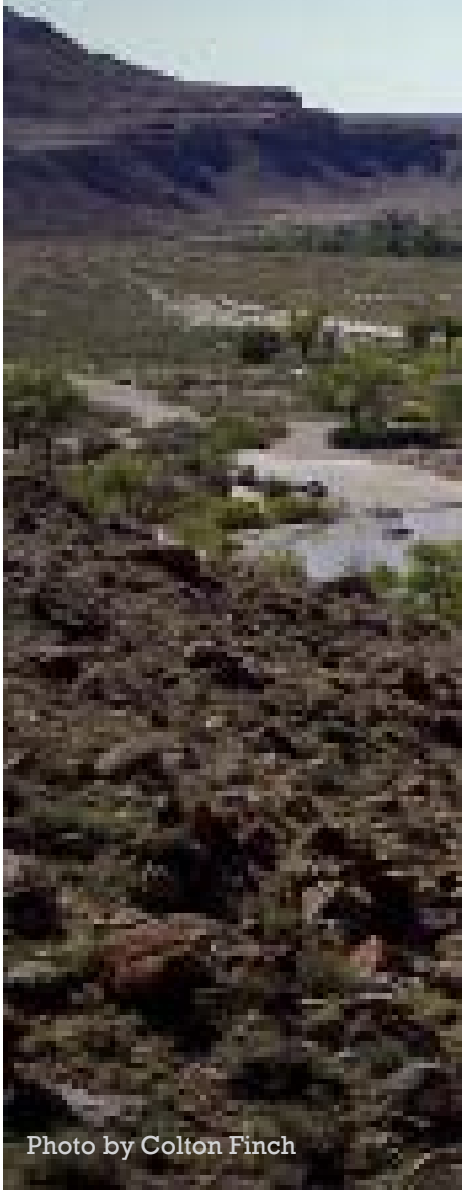


Photo by Colton Finch

Stephen Klobucar
Aquatic Ecology
Ph.D. Candidate

Harrison Mohn
Fisheries Biology
Master's Candidate

Bryan Maloney
Aquatic Ecology
Master's Candidate

Ben Stout
Aquatic Ecology
Master's Candidate

Andrew Sims
Wildlife Ecology
Master's Candidate

Staff

Shauna Leavitt
Business Assistant

Publications

BISSONETTE

PUBLISHED
Vetter, D., I. Storch, and **J. A. Bissonette**. 2015. Advancing landscape ecology as a science: The need for consistent reporting guidelines. Landscape Ecology. Online: DOI 10.1007/s10980-015-0296-z

Olson, Daniel; **J. A. Bissonette**, P. Cramer, K. Bunnell, D. Coster, P. Jackson. 2015. How does winter weather affect deer-vehicle collision rates? Wildlife Biology 21:80-87. doi:10.2981/wlb.00043

BUDY

IN REVIEW
Winters, L.K., **P. Budy**, and G.P. Thiede. *In review.* 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 34:1033–1046. *Submitted 1 April, 2016. UJFM-2016-0062.*

Klobucar, S.L., W.C. Saunders, and **P. Budy.** *In review*. A Lota lota consumption: trophic dynamics and niche space influence of invasive Burbot in a valuable sport fishery. Transactions of the American Fisheries Society. *Submitted 3 March, 2016. TAFS-2016-0049.*

Meredith, C.S., **P. Budy**, and M. Hooten. *In review.* Assessing abiotic conditions influencing the longitudinal distribution of exotic brown trout in a mountain stream: a spatially-explicit modeling approach. Biological Invasions. BINV-S15-00661-1. *Submitted 28 September, 2015. USGS IP-069503*

Saunders, W.C., and **P. Budy.** *In review.* Can high densities of Bonneville cutthroat trout prevent brown trout establishment through biotic resistance. *Re-Submitted April 2015. Manuscript ID:CJFAS. USGS IP-049187.*

PUBLISHED
Bennet, S., B. Roper, R. Al-Chokhachy, and **P. Budy**. 2014. Annual Variation of Spawning Cutthroat Trout in a Small Western USA Stream: A Case Study with Implications for the Conservation of Potamodromous Trout Life History Diversity. North American Journal of Fisheries Management 34:1033–1046. USGS FSP:IP-050825.

Laub, B.G., and **P. Budy.** 2015. Assessing the likely effectiveness of multi-species management for imperiled desert fishes using niche overlap analysis. Conservation Biology. Early on-line DOI: 10.1111/cobi.12457. USGS FSP: IP-058151.58.

Hafen, K. and **P. Budy**. 2015 Agonistic behavior among three stocked trout species. North American Journal of Fisheries Management, Management Brief: 35:3, 551-556. USGS FSP: IP-058150.

Budy, P., M. M. Conner, N.L. Salant, and W. Macfarlane. 2015. An Occupancy-based Assessment of Regional Vulnerability for Desert Fishes of the SW USA. Conservation Biology *Early on-line.* DOI: 10.1111/cobi.12513. Manuscript ID: CB14-533R. *USGS FSP: IP-049189.*

Walsworth, T.E., and **P. Budy**. 2015. Integrating non-native species in niche models to prioritize native fish restoration activity locations along a desert river corridor. Transactions of the American Fisheries Society 144:667–681. *USGS FSP: IP-034122.*

Dibble, K.L., C.B. Yackulic, T.A. Kennedy, **P. Budy**. 2015. Flow management and fish density regulate salmonid recruitment and adult size in tailwaters across western North America. Ecological Applications. 25:2168-2179.

Laub, B. G., J. Jimenez, and **P. Budy**. 2015. Adopting science-based restoration in practice: application to a desert river system. Environmental Management ONLINE FIRST: DOI 10.1007/s00267-015-0481-5. *USGS FSP: IP-053441.*

Winters, L. and **P. Budy**. *In press.* Exploring crowded trophic niche space in a novel reservoir fish assemblage: how many predators is too many? Transactions of the American Fisheries Society. 144:1117-1128. DOI: 10.1080/00028487.2015.1083475.

Klobucar, S. and **P. Budy**. *In press.* Consequences of seasonal variation in reservoir water level for predatory fishes: linking visual foraging and prey densities. Canadian Journal of Fisheries and Aquatic Sciences. cjfas-2015-0008.R1. *Accepted 26 August, 2015. USGS FSP: IP-058204.*

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.llosera. Wiley.

EDWARDS

IN REVIEW

Edwards, Jr., T. C., Jr., F. Kienast, J. Bolliger, and T. Dalang. Maintaining high Alp dry grassland meadows of high conservation priority under short- and long-term ecological

change. In review, Biological Conservation.

Gross, D.H., J.A. Logan, and **T.C. Edwards, Jr**. Mountain pine beetle fecundity and offspring size differ among lodgepole pine and whitebark pine hosts. In revision, Canadian Journal of Forest Research.

Brewerton, A., and **T.C. Edwards, Jr.** Effects of fire restoration treatments on shrubsteppe passerines in the Great Basin. In revison, Western North American Naturalist.

Stoner, D.C., J.O. Sexton, H.H. Bernales, J.R. Nagol, and **T.C. Edwards, Jr**. Productivity of a mountain ungulate tracks phenological variability over a latitudinal gradient. In review, PLoS One.

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. In review, Wildlife Society Bulletin.

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. Identifying environmental and geographic characteristics of leading and trailing zones of tree species distribution tension. In review, Ecography.

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

Nagol, J. R., J. O. Sexton1, A. Anand, R. Sahajpal, and **T. C. Edwards, Jr.** Extraction of end-member phenology by spectral unmixing. In review, PLOS ONE.

PUBLISHED

Ripplinger, J., J. Franklin, and **T.C. Edwards, Jr**. 2015. Legacies of managed disturbance leave semi-arid plant communities with reduced resilience and altered composition. Journal of Vegetation Science 26:923-933.

Brungard, C.W., J.L. Boettinger, M.C. Duniway, S.A. Wills, and **T.C. Edwards, Jr**. 2015. Machine learning for predicting soil classes in three semi-arid landscapes. Geoderma 239:68-83.

Thuiller, W, T. Münkemüller, K. H. Schiffers1, S. Dullinger, V.E. Eckhart, **T. C. Edwards, Jr**., D Gravel, G. Kunstler, C. Merrow, K.M. O'Leary, N. E. Zimmermann, D. Zurell, and F. Schurr. 2015. Does probability of occurrence relate to population dynamics? Ecography 37:1155-1166.

Merow, C., M J. Smith, W. Thuiller, N. E. Zimmermann, **T. C. Edwards, Jr.**, A. Guisan, S. Normand, R. Wüest, and J. Elith. 2015. What do we gain from simplicity versus complexity in species distribution models? Ecography 37:1267-1281.

Presentations

BISSONETTE

2015 Sillero, N., **Bissonette,J. A**., Shilling, F., and Perkins, S. 2015. Using citizen science, social networking and emerging technologies to efficiently and accurately collect data on the impacts of roads and traffic on wildlife. A symposium at the joint conference of the International Congress of Conservation Biology and the European Congress of Conservation Biology, 6 th August 2015

2016 **Bissonette, J. A**. 2016. Invited keynote address, LIFE STRADE Project „Demonstration of a system for the management and reduction of road collisions with wildlife". 4-5 Octber. Umbria, Italy. [http://www.lifestrade.it/index.php/en/]

BUDY

Klobucar, S.L. and **P. Budy**. 2014. In hot(ter) water: predicting zooplankton biomass and arctic char growth and consumption under climate change scenarios on the Alaska North Slope. Poster. Arctic Long Term Ecological Research, 25-28. February, 2014, Woods Hole, Massachusetts.

Laub, B. G., J. Jimenez, and **P. Budy.** 2014. Restoration and monitoring plan for native fish and riparian vegetation on the San Rafael River, Utah. Tamarisk Coalition Research and Management Conference, 18-20 February, 2014, Grand Junction, Colorado, USA.

Budy, P. 2014. Challenges to desert fish conservation and river restoration in the arid West: How can we avert the perfect storm? University of Missouri, Dept. of Fisheries and Wildlife Sciences. Invited Lecture: 5 March, 2014 Michael Dunmire Lecture Series.

Laub, B. G. and **P. Budy**. 2014. All as one or one for all? Assessing the likely effectiveness of managing three native species (bluehead sucker, flannelmouth sucker, and roundtail chub) as an ecological complex. American Fisheries Society, Utah Chapter, 11-14 March, 2014, Price, Utah, USA.

Chapman, K., **P. Budy**, and F, Howe. 2014. Evaluating the potential impacts of American white pelican predation on Bonneville cutthroat trout in Strawberry Reservoir, UT. Poster. American Fisheries Society, Utah Chapter, 11-14 March, 2014, Price, Utah, USA.

Reynolds, J. **and P. Budy**. 2014. The effects of water quality on fish species in Cutler Reservoir. Poster. American Fisheries Society, Utah Chapter, Price, Utah, 12-13 March 2014.

Breen, M.J., G. P. Thiede, **P. Budy**, M. D. Fiorelli, S. Klobucar, and P. MacKinnon 2014. Population demographics and habitat criteria for three sensitive fishes: why is the White River unique? American Fisheries Society, Utah Chapter, 11-14 March, 2014, Price, Utah, USA.

Mohn, H., B. Roper, **P. Budy**. 2014. Quantifying Bonneville Cutthroat Trout spawning movement within the Logan River watershed with consideration to potential metapopulation structure and management. American Fisheries Society, Utah Chapter, 11-14 March, 2014, Price, Utah, USA.

Laub, B. G., J. Jimenez, and **P. Budy**. 2014. Restoration and monitoring plan for native fish and riparian vegetation on the San Rafael River, Utah. 2014 Spring Runoff Conference, 1-2 April, 2014, Logan, Utah, USA.

Budy, P., M. M. Conner, N.L. Salant, and W. Macfarlane. 2014. The clock is ticking for desert fishes of the SW USA: An occupancy-based assessment of regional vulnerability. American Fisheries Society, Western Division, 7-11 April, 2014, Mazatlán, Mexico.

Klobucar, S.L. and **P. Budy**. 2014. In hot(ter) water? predictions of arctic char growth and consumption under climate change scenarios on the Alaska North Slope. American Fisheries Society, Western Division, 7-11 April, 2014, Mazatlán, Mexico.

Macfarlane, W.W., **P. Budy**, G. P. Thiede, and B. G. Laub. 2014. Looking beyond the mainstem for conservation of restoration of endangered Colorado River fishes. American Fisheries Society, Western Division, 7-11 April, 2014, Mazatlán, Mexico.

Mohn, H., B. Roper, **P. Budy**. 2014. Investigating Bonneville Cutthroat Trout spawning movement within the Logan River watershed with consideration to potential metapopulation structure and management. American Fisheries Society, Western Division, 7-11 April, 2014, Mazatlán, Mexico.

Laub, B. G. and **P. Budy**. 2014. All as one or one for all? Assessing the likely effectiveness of multi-species management. American Fisheries Society, Western Division, 7-11 April, 2014, Mazatlán, Mexico.

Thiede, G.P., **P. Budy**, P. MacKinnon, D. Speas, M. Breen, and K. McAbee. 2014. Frequent tributary usage by the endangered and large-river fishes of the Upper Colorado River basin. American Fisheries Society, Western Division, 7-11 April, 2014, Mazatlán, Mexico.

Budy, P. and Belmont, P. 2014. Understanding wildfire effects on fish populations and stream geomorphology. *Invited Presentation.* UDWR Aquatic Section Meeting, 14 April, 2014, Midway, UT.

Dibble, K.L., C. B. Yackulic, T. Kennedy, and **P. Budy**. 2014. Factors influencing the size of salmonids in regulated river systems: a synthesis of data from the Western United States. Joint Aquatic Sciences Meeting; Portland, OR; May 18-23, 2014.

Finch, C. and **P. Budy**. 2014. Habitat mediated dispersal and recolonization in stream fish following a severe fire. Poster. Joint Aquatic Sciences Meeting; Portland, OR; May 18-23, 2014.

Dibble, K.L., C. B. Yackulic, T. Kennedy, and **P. Budy**. 2014. An examination of the processes that regulate fish size downriver of dams in the Western United States. 144th Annual Meeting of the American Fisheries Society; Quebec City, Canada; August 17-21, 2014.

Budy, P. and S. Klobucar. 2014. Understanding how lake populations of arctic char are structured and function with special consideration of the potential effects of climate change: a multi-faceted approach. *Invited Presentation*. American Fisheries Society, Alaska Chapter Juneau, Alaska, October, 2014.

Budy, P. 2015. Why are we doing this and what are we learning: application and context for widespread PIT-tagging efforts in the Upper Colorado River Basin. *Invited Presentation.* Upper Colorado Researchers Meeting, Moab, Utah, January 13-15, 2015.

Goethlich, J. S.L. Klobucar, D.H. Ogle, and **P. Budy**. 2015. The effects of experimental lake fertilization on condition and diet of slimy sculpin (cottus cognatus) in oligotrophic arctic lakes, North Slope, AK. Annual Meeting, Wisconsin Chapter of the American Fisheries Society, Eau Claire, WI, February 24-26, 2015.

Budy, P. 2015. Understanding the effects of increased drying (intermittency) on desert fishes of the SW. *Invited Presentation*, International Symposium on Fish Ecology in Intermittent stream systems. Brazilian Society of Ichthyology, January 31-February 8, Recife, Brazil.

Finch, C. and **P. Budy**. 2015. Bringing back the trout: metapopulation viability of Bonneville cutthroat trout in a fire-impacted watershed. Annual Meeting, Utah Chapter of the American Fisheries Society, Moab, Utah, 26-28 March 2015.

Klobucar, S.L. and **P. Budy**. 2015. Consequences of seasonal variation in reservoir water level for predatory fishes: linking visual foraging and prey densities. Annual Meeting, Utah Chapter of the American Fisheries Society, Moab, UT, March 24-25, 2015.

Malmborg, N., G.P. Thiede, and **P. Budy**. 2015. Comparing two methods for sampling and estimating abundance of mottled sculpin in the Logan River, Utah. Poster. American Fisheries Society, Utah Chapter, Moab, Utah, March 2015.

Simmons, L., S. Klobucar, and **P. Budy**. 2015. Comparison of composition and variation of arctic char diets in a pristine arctic lake system and an artificially fertilized lake. Poster. American Fisheries Society, Utah Chapter, Moab, Utah, March 2015.

Chapman, K.C., **P. Budy**, F. Howe. 2014. Evaluating the potential impacts of American white pelican predation on Bonneville cutthroat trout in Strawberry Reservoir, Utah. Annual Meeting, Utah Chapter of the American Fisheries Society, Moab, Utah, 26-28 March 2015.

Reynolds, J., **P. Budy**, K. Chapman, and G. P. Thiede. 2015. Understanding the role of non-game fish in pelican diet and distribution at Strawberry Reservoir, UT. American Fisheries Society, Utah Chapter, Moab, Utah, 25 March 2015.

Budy, P. and W.C. Saunders. 2015. Can high densities of native trout limit expansion of exotic trout through

biotic resistance? International Symposium. Advances in the Population Ecology of Stream Salmonids IV. 25-29 May, Girona, Spain.

Thiede, G.P., **P. Budy**, H. Mohn, and B. Roper. 2015. International Symposium. Evaluating movement and spatial population structure for stream-dwelling cutthroat trout: implications for management and conservation practices. Advances in the Population Ecology of Stream Salmonids IV. 25-29 May, Girona, Spain.

Chapman, K. and **P. Budy**. 2015. Evaluating the potential impacts of pelican predation on cutthroat trout in Strawberry Reservoir, Utah, Annual Meeting of the American Fisheries Society, National; Portland, Oregon, August 17-21, 2015.

Laub, P. W. Macfarlane, G.P. Thiede and **P. Budy**. 2015. Looking beyond the mainstem for conservation and restoration of endangered and sensitive Colorado River fishes. Annual Meeting of the American Fisheries Society, National; Portland, Oregon, August 17-21, 2015.

Finch, C. and **P. Budy**. 2015. Bringing back the trout: metapopulation viability of Bonneville cutthroat trout in a fire-impacted watershed. Annual Meeting of the American Fisheries Society, National; Portland, Oregon, August 17-21, 2015.

Strohm, D. and **P. Budy**. 2015. Matching watershed and otolith chemistry to establish natal origin of an endangered desert lake sucker. Annual Meeting of the American Fisheries Society, National; Portland, Oregon, August 17-21, 2015.

Klobucar, S.L., J.W. Gaeta and **P. Budy**. 2015. A changing menu in a changing climate? Predicting the availability of fish food in warmer arctic lakes. 145th Annual Meeting of the American Fisheries Society, Portland, OR, August 16-20, 2015.

Finch, C. and **P. Budy**. 2015. Bringing back the trout: metapopulation viability of Bonneville cutthroat trout in a fire-impacted watershed. Restoring the West Conference 2015, Logan, Utah, October 28-29, 2015.

Budy, P. 2015. The Clock is Ticking: An Occupancy-based Assessment of Regional Vulnerability for Desert Fishes of the SW USA. Upper Colorado River Basin Water Forum, Grand Junction CO, October 28, 2015.

Klobucar, S.L., L. Simmons, G.P. Thiede, and **P. Budy**. 2015. Simplified complexity or complex simplification? Lentic fish communities on the North Slope, Alaska. *Invited presentation.* Annual Meeting, Alaska Chapter of the American Fisheries Society, Homer, AK, 4-6 November, 2015.

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.

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.

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. 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.

Finch, C., **P. Budy**, and P. Belmont. 2016. A future of fire, floods, and fish. Annual Meeting, Utah Chapter of the American Fisheries Society, Altamont, Utah, 15-17 March 2016.

EDWARDS

Stoner, D.C., and **T.C. Edwards, Jr.** Climate and land-use change in the Southern Rockies using satellite imagery to inform mule


Photo by Colton Finch

deer conservation. Invited webinar, Southern Rockies Landscape Conservation Cooperative, 9/22/2015.

Sexton, J.O., A. Anand, D. Choate, D. Stoner; J.R Nagol, and **T.C. Edwards, Jr**. Satellite-based monitoring of ecosystem dynamics: applications in forest, urban, and wildlife conservation. Invited presentation, Indian National Center for Biological Sciences, Bangalore, India 9/19/2015.

Ironside, K.E., D. Mattson, D. Choate, D. Stoner, T. Arundel, J. Hansen, T. Theimer, B. Holton, B. Jansen, J. Sexton, K. Longshore**, T. Edwards, Jr**, and M. Peters. Offered poster, GPS telemetry: probability of fix acquisition. 2015 ESRI User Conference (UC), San Diego, California, 7/22/2015.

Edwards, T.C. Jr., R.W. Hergert, R. D. Fitts, and F. Kienast. An optimization approach to assessing landscape-scale energy development effects on rare plant species in the Colorado Plateau of western North America. Invited paper, 9th International Association of Landscape Ecology World Congress, Portland, Oregon, 7/7/2015.

Machado, N.J., **T.C Edwards, Jr.,** J. Gibson, and M.S. Biudes. Assessing the efficiency of a protected area system in a Neotropical region using species distribution modeling. Offered paper, 9th International Association of Landscape Ecology World Congress, Portland, Oregon, 7/7/2015.

Edwards, T.C., Jr, J. Gibson, G.G. Moisen, T.S. Frescino, and N.E. Zimmermann. Differential life stage niche modelling in conifers of western North America. Offered paper, Université Grenoble Alpes, Laboratoire d'Écologie Alpine, Grenoble, France, 4/9/2015.

Guttery, M.R., and **T.C. Edwards, Jr.** Landscape conservation planning: identification of watersheds with high conservation potential across Utah and the Colorado Plateau Ecoregion. Offered paper, 2015 Annual Meeting of the Utah Chapter of The Wildlife Society, Moab, Utah, 3/19/2015.

Edwards, T.C., Jr., D.C. Stoner, J.O. Sexton, H.H. Bernales, and J.R. Nagol. Productivity of mule deer tracks phenological variability over a latitudinal gradient. Offered paper, 2015 Annual Meeting of the Utah Chapter of The Wildlife Society, Moab, Utah, 3/19/2015.

Sims, S.A., D. Stoner, H. Bernales, K. Hersey, J. Nagol, J.O. Sexton, and **T.C. Edwards, Jr.** Modeling the relationship between mule deer (*Odocoileus hemionus*) population dynamics and primary productivity. Offered paper, 2015 Annual Meeting of the Utah Chapter of The Wildlife Society, Moab, Utah, 3/19/2015.

Stoner, D.C., J.O. Sexton, A. Sims, H. Bernales, J. Nagol, D.J. Mattson, K.E. Ironside, K. Longshore, D.M. Choate, and **T.C. Edwards, Jr.** Weather, plants, and large mammals: satellite observations of vegetation phenology inform wildlife management in the Intermountain West. Offered paper, 2015 Annual Meeting of the Utah Chapter of The Wildlife Society, Moab, Utah, 3/19/2015.

Kleinhesselink, A., A. Compagnoni, J.B. Koch, L. Long**, T.C. Edwards, Jr.,** and P.B. Adler. Who will manage sagebrush habitats in a future of rapid climate change?

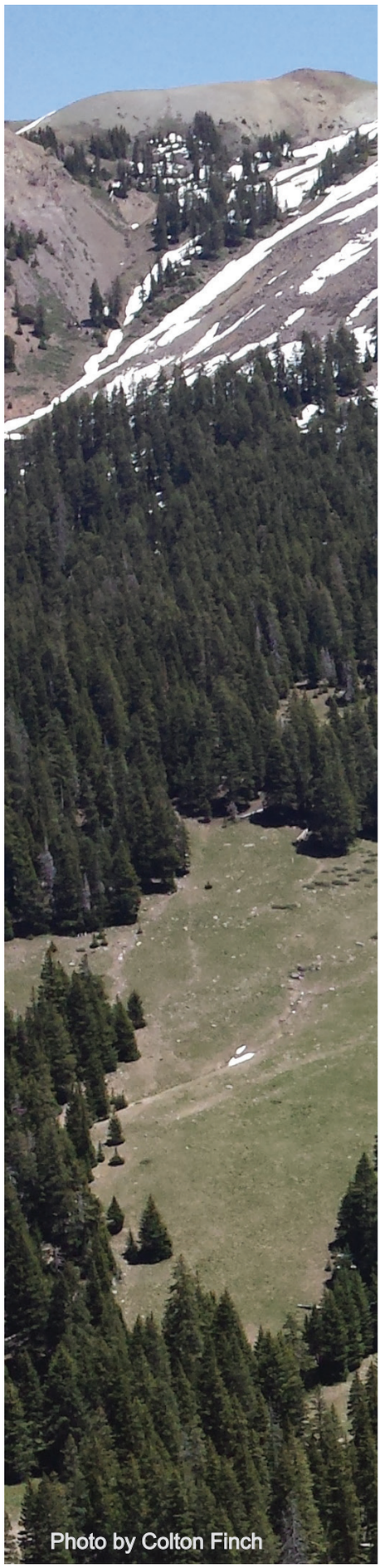


Photo by Colton Finch

Invited paper, 68th Annual Meeting of the Society for Range Management, Sacramento, CA 31/01/2015.

Popular Media

Leavitt, Shauna L. (Winter 2016). *The Long Drive of Dreams.* Utah State. Retrieved from https://issuu.com/usuprm/docs/utah_state_magazine_winter_2016/26?e=1295814/32474721

Leavitt, Shauna L. (2015, February 5). *Mapping the Tushar Mountain streams.* Retieved from http://wildlife.utah.gov/blog/2015/mapping-the-tushar-mountain-streams/

Maloney, Bryan. (2015, October). *Weber River Bluehead Sucker Population Recruitment Bottleneck.* USGS-CRU Coop Catch-Up

Research Grants (Active)

BUDY

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. US Geological Survey, South Central Climate Science Center, Total Award *to date* $131,725.

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

2015- present. Upper Colorado River Basin: Adaptive management with and installation and development of methods and analyses for PIT tag technology and data. Principal Investigators: Budy and Conner. Bureau of Reclamation (DOI), Total Award *to date* $650,000.

2013-present. Understanding the effects of wildfire on fish populations and stream geomorphology in Twitchell Canyon. Principal Investigator: Budy. Utah Division of Wildlife Resources, UDWR, Total Award *to date* $156,254.

2007-present. San Rafael and Price Rivers (UCRB): Adaptive management, research, and restoration, implementation & monitoring. Bureau of Reclamation (BOR) and Bureau of Land Management (BLM), Total Award *to date*: > $628,666.

2014-2016. Ecological changes in aquatic communities in the Big Bend reach of the Rio Grande: Synthesis and future monitoring needs. USFWS, Desert Landscape Conservation Cooperative, Total Award, $49,860.

2015-present. Weber River, Bluehead Sucker Recruitment Bottleneck Study. 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 (UDWR) & Cutthroat Trout Restoration (USFS- RMRS). Principal Investigator: Budy. Utah Division of Wildlife Resources, UDWR, USFS, Total Award $190,345.

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

2011-2015. Movement and Habitat Studies of Endangered Fishes in the Colorado River Basin. Bureau of Reclamation (BOR), Activities to Avoid Jeopardy Program, Total Award $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: Budy. Utah Division of Wildlife Resources, UDWR, 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: Phaedra Budy. US Fish and Wildlife Service (USFWS), Total Award $1,515,024.


Photo by Colton Finch

RESEARCH PROPOSALS SUBMITTED AND PENDING:
2015. Budy, P., A. Giblin, B. Crump, S. Null, J. Jin. Collaborative research: an exploration of the direct and indirect effects of climatic warming on arctic lake ecosystems. National Science Foundation: Office of Polar Programs. $999,335.

2015. Budy, P., J.Gaeta, and R. Al-Chokhachy. A synthesis of long-term fish response to climate and climate change with implications for sustainable harvest in the future: what can we learn from a cross-site comparison of arctic and northern temperate lakes? USGS, Mendenhall Postdoctoral Fellowship, ~$122,972 {2 yr. GS12 salary}.


Photo by Colton Finch

EDWARDS

2015-2017. Distribution patterns and vegeation dynmaics of foest canopy trees in the Northern Pantanal, Mato Gross, Brasil (PI), República Federativa do Brasil, CNPg & CAPES, $46,600 (R$175,000)

2015-2016. Weather and primary productivity mediated effects on mule deer population dynamics across a latitudinal gradient (PI), Utah Division of Wildlife Resources, $37,400

2014-2017. Rare Plants (PI), Utah Division of Wildlife Resources, $37,400, Bureau of Land Management, $225,000

2011-2017. Landscape-Scale Decision Support Models for the Southern Rocky Mountains (PI), Bureau of Land Management, $225,000, U.S. Fish and Wildlife Service, $168,000

2011-2017. Step-down demonstration analyses of plants and animals under the BLM Rapid Ecoregional Analysis process (PI), Bureau of Land Management, $318,300

2011-2015. Spatial responses to climate across trophic levels: monitoring and modeling plants, prey, and predators in the Intermountain Western United States (Co-PI), NASA, $533,300

Graduate Students Directed

BUDY

COMPLETED
Winters, Lisa. 2014. An evaluation of the food web dynamics and predator prey interactions in Scofield Reservoir. MS Thesis. Ecology. Utah State University.

Dean, Andy. 2014. An evaluation of the relative performance of diploid versus triploid brook trout with consideration of the influence of lake characteristics. MS Thesis. Ecology. Utah State University.

Heredia, Nicholas. 2014. Trophic status, energetic demands, and factors affecting Lahonton cutthroat trout distribution in Pyramid Lake, Nevada. MS Thesis. Ecology. Utah State University.

Strohm, Deanna. 2015. Matching watershed and otolith microchemistry to establish natal origins of an endangered desert lake sucker. MS Thesis. Ecology. Utah State University.

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. *Slated date of completion: May 2016.*

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. *Slated date of completion: Fall 2018.*

Finch, Colton. *In progress.* Fires, floods, and fish: projecting population recovery in an inland watershed.. PhD Dissertation. Ecology. Utah State University. *Slated date of completion: Fall 2018.*

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

Stout, Benjamin. *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: Fall 2016.*

EDWARDS

IN PROGRESS
Andrew (Steven) Sims. *In progress..* Effects of interannual climate and primary productivity on mule deer survival and fecundity. MS Thesis. Ecology. Utah State University

Slated date of completion: 2017.

Research Associates Directed

BUDY

Laub, B. 2012 - present. Post-doctoral fellow, Conservation applications for imperiled dessert fishes: identifying restoration potential of desert rivers.

Schorr, R. 2016 –present. Analytical assessment of the status of endangered fishes in the Upper Colorado River Basin.

EDWARDS

Jacob Gibson, Research Associate, Sustainable communities and landscape designs

David Stoner, Post-doctoral Research Associate, Spatial responses to climate across trophic levels: monitoring and modeling plants, prey, and predators in the Intermountain Western United States

Robert Fitts, Research Associate, Habitat modelling rare plant species in the Colorado Plateau

Michael Guttery, Post-doctoral Research Associate, Decision support systems for the BLM Colorado Plateau REA and FWS Southern Rockies LCC

Visiting Scholar Collaoration

BUDY

Becares, Eloy. 2014-2015. Dept. of Ecology, Faculty of Biological Sciences, University of Leon, Spain. Collaboration with Budy for mini-sabbaticals (2) in Watershed Sciences at Utah State University. Ecosystem resilience to invasive species and the consequences of invaders on biodiversity and ecosystem health.

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 Brasilian version of the U.S. Fullbright Program). Collaborative Research with T. Edwards: Selection of priority areas for conservation in Mato Grosso state based on ecological niche modeling, potential distribution of species and landscape structure.

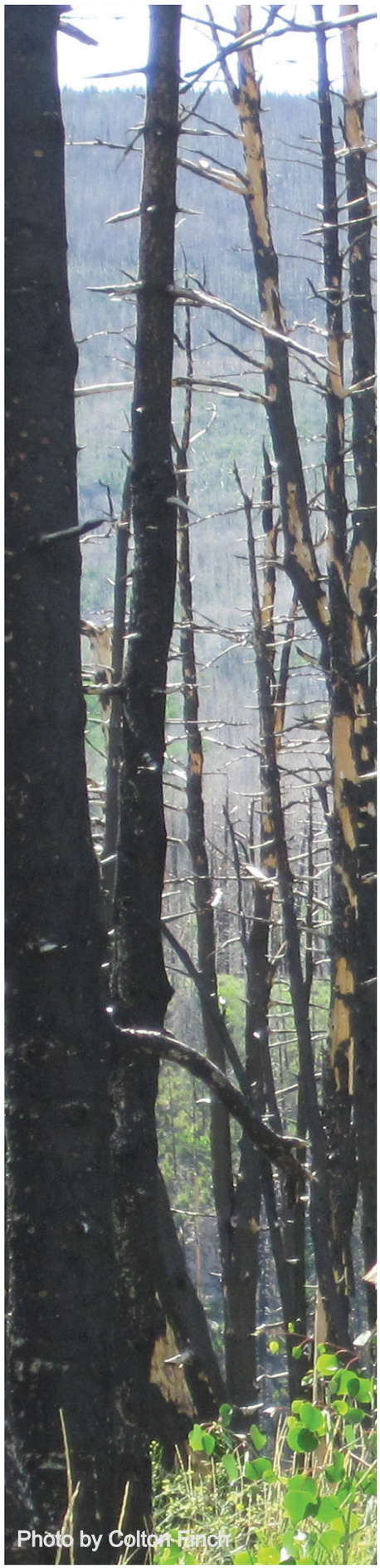


Photo by Colton Finch

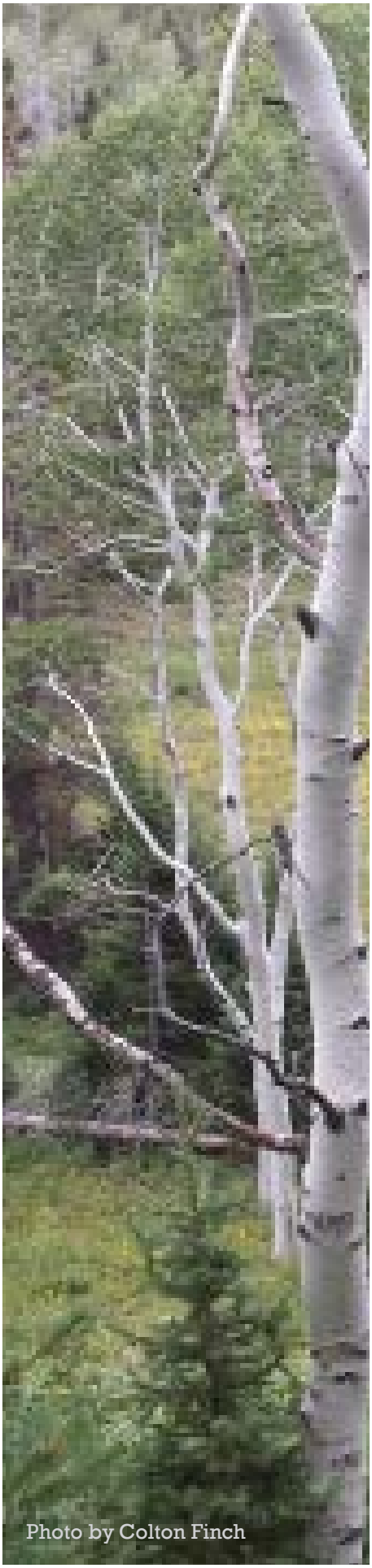


Photo by Colton Finch

Undergraduate Research Projects Advised

BUDY

Malmborg, N. 2015. Comparing two methods for sampling and estimating abundance of mottled sculpin in the Logan River, Utah. Poster presentation at the Utah Chapter, American Fisheries Society Meeting, March 2015, Moab, UT. "Best Poster" Award Winner. USU QNCR Travel grant application submitted 2015.

Reynolds, J. 2015. Understanding the role of non-game fish in pelican diet and distribution at Strawberry Reservoir, UT. Prepared for presentation at the Utah Chapter, American Fisheries Society Meeting, March 2015, Moab, UT and USU Student Showcase, 2015. Successfully competed for USU QCNR Travel grant and USU Honors Research for Undergraduates grant.

Simmons, L. 2015. Trophic position and niche-space dynamics of apex predators in arctic lakes. USU URCO Grant Application Subitted 2, 2015. Poster presentation at the Utah Chapter, American Fisheries Society Meeting, March 2015, Moab, UT. USU URCO Research grant application submitted 2015.

Hafen, K. 2014. Agonistic behavior between rainbow, cutthroat, and tiger trout in a novel Utah reservoir community. *PUBLISHED:* Hafen, K. and P. Budy. 2015 Agonistic behavior among three stocked trout species. North American Journal of Fisheries Management, Management Brief: 35:3, 551-556. USGS FSP: IP-058150.

Professional & Academic Service

BISSONETTE

INVITED EXTERNAL THESIS/ DISSERTATION EXAMINER

Akhtar, Muhammad. 2015. Eco-biology and conservation of potential insectivorous birds in the arable biomes of Central Punjab. Ph.D. Thesis, Department of Forestry, Range Management, and Wildlife, University of Faisalabad, Pakistan. Evaluated December 12, 2014.

Raiter, Keren Gila. 2016. Enigmatic ecological impacts of mining and linear infrastructure development in Australia's Great Western Woodland. Ph.D. Dissertation, School of Plant Biology, The University of Western Australia. Evaluated February 23, 2016

REVIEWER

Global Ecology and Biogeography, Journal of Applied Ecology n=2, Biological Conservation, Wildlife Society Bulletin

BUDY

COMMITTEE SERVICE

USU, Watershed Sciences Undergraduate Degree and Curriculum Revision Committee, 2015-2016.

USU, Honors Application Review Committee, 2015.

USU, Quinney College of Natural Resources, Undergraduate Scholarship Committee, 2015.

USU, Quinney College of Natural Resources, Faculty and Staff Academic Awards Committee (2011, 2012, 2013, 2014, 2015).

USU, New Faculty Teaching Academy, Teaching Mentor for Jereme Gaeta, 2015.

USU, Watershed Sciences, Fish Ecologist Faculty Search Committee (2014).

REVIEWER FOR:
2015. Ecology of Freshwater Fish (n=3), Biological Conservation, Fisheries, Canadian Journal of Fisheries and Aquatic Sciences, Ecological Applications, ArcticNet Project Proposal review.

2014. Ecology of Freshwater Fish (n=4), Journal of Fish and Wildlife Management, Southwest Naturalist, Journal of Fish Biology, National Science Foundation, Division of Environmental Biology Proposal review.

PROFESSIONAL SERVICE
Associate Editor, 2010 – present, Ecology of Freshwater Fish.

American Fisheries Society, Education Section, Western Division Representative, 2014-present.

American Fisheries Society & Sea Grant, Best Student Paper/Poster Symposium. May 2014.

American Fisheries Society, Professional Networking Opportunity, Presentation and Roundtable for students et al., Utah Chapter, Price, UT, 12 March, 2014.

COURSES TAUGHT

Utah State University, Quinney College of Natural Resources, Watershed Sciences Department , Graduate Induction Class, lake fish ecology, 2014 – Jackson Lake, WY, 2015 – Bear Lake, UT.

Fish Diversity and Conservation (WATS 3100 lecture, 3110 laboratory). Utah State University, College of Natural Resources, Watershed Sciences Department, 2014, 2015 (Co-taught with J. Gaeta).

EDWARDS

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.


Photo by Ben Stout

Workshops & Training

BUDY

Utah Department of Natural Resources: Climate Change Introductory Workshop. Budy & Edwards, Coordinators. 12 May, 2014. Workshop provided to DNR Employees and Selected Officials from the Governor's office, upon request including three selected USU professors from different disciplines.

Utah Division of Wildlife Resources: Climate Change Introductory Workshop. Budy & Edwards, Coordinators. 18 April, 2014. Workshop provided to UDWR Biologists and Upper Administration upon request including four selected USU professors from different disciplines and one USFS invited scientist.

EDWARDS

baseR: Data Management and Manipulation in R, U.S. Geological Survey, Menlo Park Science Center, Menlo Park, California. 1/13-16/2015. 32 participants.

baseR: Data Management and Manipulation in R, U.S. Geological Survey, Southwest Biological Science Center, Flagstaff, Arizona. 7/20-24/2015. 37 participants.

Species Distribution Models in R, 2015 World Congress, International Association for Landscape Ecology, Portland, OR. 7/4-6/2015. 36 participants.

gis R: Basic Geographic Information Systems Analysis, 2015 World Congress, International Association for Landscape Ecology, Portland, OR. 7/6-7/2015. 41 participants.

baseR: Data Management and Manipulation in R, Instituto Federal de Mato Grosso, Cuiaba, Mato Grosso, Brasil. 8/17-19/2015. 25 participants.

statR2: Descriptive Statistics and Basic Graphing in R, Instituto Federal de Mato Grosso, Cuiaba, Mato Grosso, Brasil, Cuiaba, Mato Gross, Brasil. 8/22-24/2015. 25 particpnats.

gisR: Basic Geographic Information Systems Analysis, Instituto Federal de Mato Grosso, Cuiaba, Mato Grosso, Brasil, Cuiaba, Mato Gross, Brasil. 9/2-4/2015. 17 participants.

Species Distribution Models in R, Instituto Federal de Mato Grosso, Cuiaba, Mato Grosso, Brasil, Cuiaba, Mato Gross, Brasil. 9/10-14/2015. 15 participants.

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

USGS/DOI Star Award. 2015 Superior Performance (1% of salary). November, 2015.

USU, S.J. and Jessie E. Quinney, College of Natural Resources, Large Grant Recipient Award. Research Week Awards Gala. April, 2015

American Fisheries Society, Honoree for "Ladies Night", Hosted by the Equal Opportunity Section and the Student Subsection of the American Fisheries Society, 2014. Award highlights the positive impact women have had on AFS and on fisheries science by showcasing the contributions of female researchers, both past and present.

EDWARDS

USGS/DOI Star Award. 2015 Superior Performance (1% of salary). November, 2015.

Photo by Bryan Maloney

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

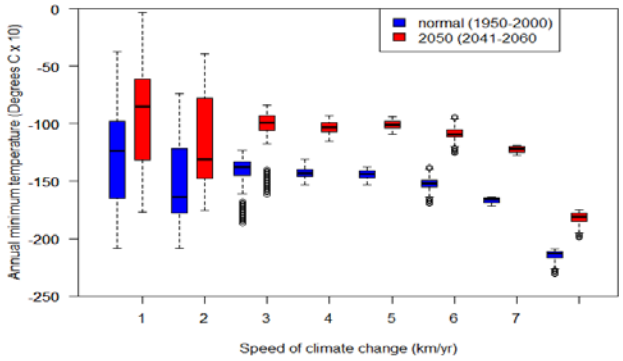
Three combined efforts serve as a step-down demonstration analysis of the Bureau of Land Management's (BLM) Rapid Ecoregional Assessment (REA) process which is currently being implemented across BLM-owned and managed lands. These include (i) quantitative assessments of a Gunnison sage-grouse bioclimatic 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



Spatial responses to climate across trophic levels: monitoring and modeling plants, prey, and predators in the Intermountain Western United States

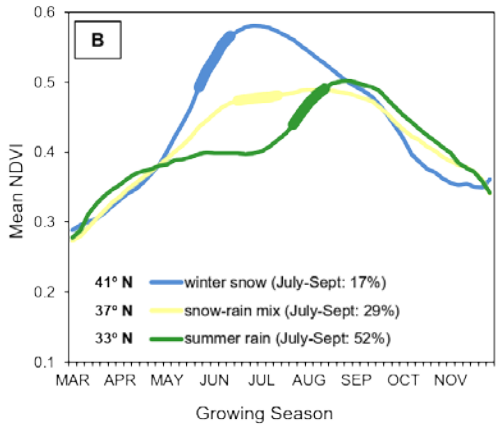
We investigated the impact of climate on trophic linkages between primary productivity, herbivores, and top predators across western United States landscapes. Using the 2011 NLCD land-cover map and 14 years of MODIS NDVI composites of vegetation, we modeled land surface phenology based on geospatial 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.

FUNDING
National Aeronautics and Space Administration (NASA)

INVESTIGATORS
David Stoner, Postdoc Fellow II
Andrew Sims, M.S. Candidate

FACULTY SUPPORT
Thomas Edwards, USGS, UTCFWRU, USU-Wildland Resources

PROJECT PERIOD
September 2011- July 2016



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 Endangered Species Mitigation Fund

INVESTIGATORS
Robert Fitts, Researcher Associate
Jacob Gibson, Research Technician
Benjamin Gibbons, Undergraduate Researcher
Kristian Valles, Undergraduate Researcher

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

PROJECT PERIOD
October 2012- September 2016

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

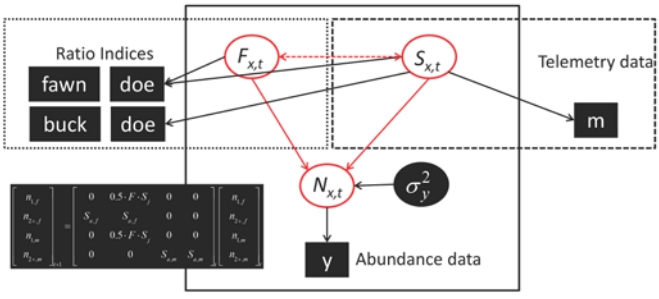
This research increases understanding of how climate influences deer demographic rates in Utah, and how these rates may change in the future. The objectives of this study are to: (i) model and project deer survival and fecundity for a range of environmental conditions at the wildlife management unit (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 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

INVESTIGATORS
Andrew Sims, M.S. Candidate

FACULTY SUPPORT
David Koons, USU-Wildland Resources

PROJECT PERIOD
August 2014 – December 2016



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. Flower's beardtongue 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 will mount. To aid in evaluating the proposed endangered species listing we will create a species distribution model using existing location and habitat information. The model will then be used to explore likely locations for new colonies.

FUNDING
Utah DNR Endangered Species Mitigation Funds

INVESTIGATORS
Robert Fitts, Research Associate
Benjamin Gibbons, Undergraduate Researcher
Kristian Valles, Undergraduate Researcher

FACULTY SUPPORT
Thomas Edwards, USGS, UTCFWRU, USU-Wildland Resources

PROJECT PERIOD
July 2015 - September 2016

Aquatic Research Projects

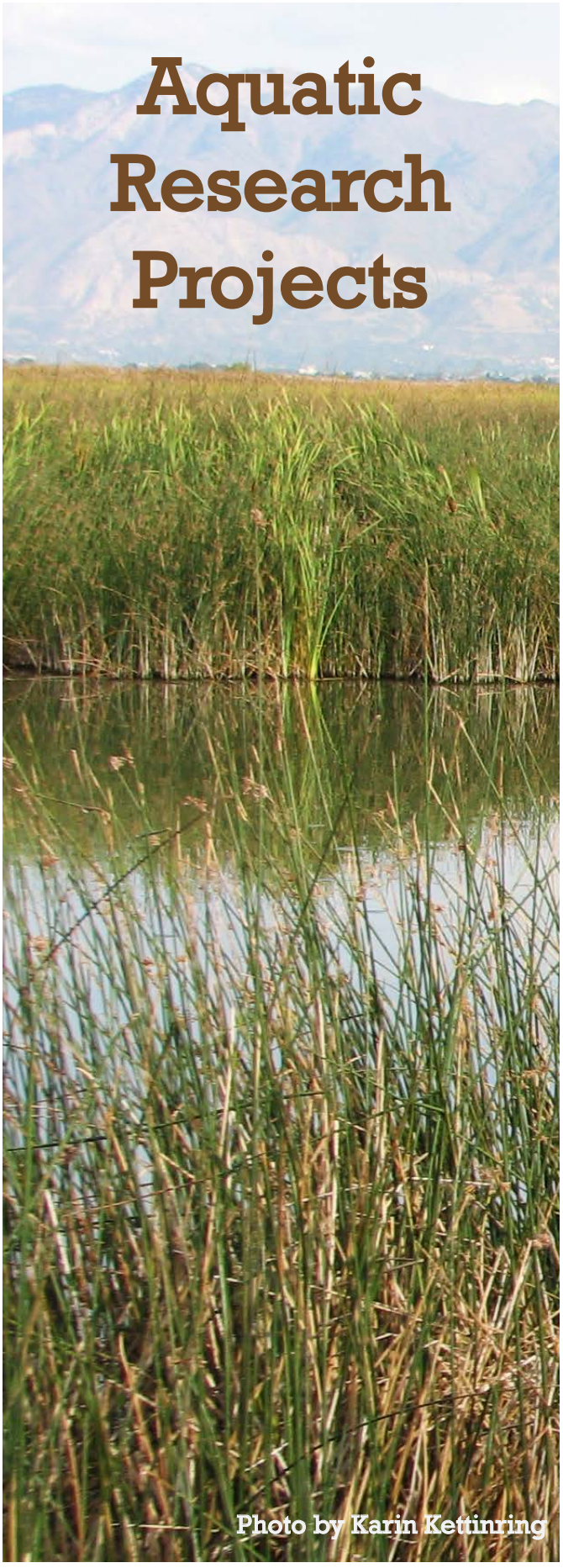


Photo by Karin Kettinring

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

Most cutthroat trout 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 and connected habitat. In 15 years, we completed a comprehensive population assessment, including depletion-based abundance estimates and a mark recapture study of site fidelity, growth, and survival. Abundance of cutthroat trout (> 100 mm TL) varied greatly by sample site, ranging from 38 fish/km at lower elevations up to 822 fish/m at higher elevations. Population trend (λ) 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 one 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 330 fish/km) and adults are now up to 270 mm in length. Our results provide important conservation and recovery benchmarks for identifying range-wide limiting factors of Bonneville cutthroat trout.

FUNDING
U.S. Forest Service, U.S. Geological Survey–UCFWRU (in-kind), Utah DWR, Trout Unlimited and others.

INVESTIGATORS
Gary P. Thiede, Research Associate
Thomas Hafen, Undergraduate Researcher
Emily Wright, Undergraduate Researcher
Justin Dorathy, Undergraduate Researcher

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

PROJECT PERIOD
2001-2015 (on-going)

Quantifying the direct and indirect effects of climate warming on arctic fishes and lake ecosystems

In the Arctic, the climate is warming faster than any other region of the globe. In the face of a warming climate, we seek to understand how warmer and longer growing seasons (ice-free period) will affect biological processes and trophic dynamics in arctic lake ecosystems on the North Slope, Alaska. Our current goals are to quantify: 1) how secondary production (e.g., fish food); and, subsequently, 2) how production and condition of fishes will be affected by a longer and warmer growing season; and, overall, 3) how these changes interact to determine survival, population growth rates, and persistence across lakes. We have shown that warmer temperatures will lead to increased consumption (28 – 34%) and growth (23 – 34%) of fish; however, these scenarios require increased prey resources for fishes, a current knowledge gap. We are using a multifaceted approach combining observations, monitoring, experiments, and modeling techniques to improve our understanding of lake ecosystems in a changing climate with regard to predator-prey dynamics.

FUNDING
National Science Foundation,
Ecology Center, Utah State University,
US Geological Survey-UCFWRU (*in-kind*)

INVESTIGATORS
Stephen Klobucar, PhD Candidate
Levi Simmons, Undergraduate Researcher

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

PROJECT PERIOD
2010- 2022

Tributary habitat use of endangered and imperiled fishes in the Price River, Utah

The Price River, Utah, provides habitat for three imperiled species (the “three species”), and there is evidence that the endangered Colorado pikeminnow also uses this tributary for foraging, spawning, and rearing. The goal of this project is to document Price River habitat use and movement by imperiled and endangered fishes, and obtain information on population abundance and distribution. We have been monitoring the extent, magnitude, direction, and timing of use by Colorado pikeminnow and the imperiled three species since October 2011 with some gaps. To date, we have documented heavy use of the Price River by 3 of the 4 endangered fishes and all 3 imperiled fishes; their movements into the Price River generally correspond with peaks in the hydrograph. In addition, we conducted detailed habitat measurements for a fine-scale habitat assessment in twenty-one survey reaches within the study section. We determined 18 % of the twenty-one sample reaches consists of pool habitat, 31.5 % is riffle habitat, and 50.5 % is run habitat. Compared to some of its neighboring tributaries, the Price River habitat is less degraded, making it a promising location for conservation and restoration. Tributary use data in combination with the habitat assessment and hydrograph data will provide important information to bridge the knowledge gaps that limit effective management of Green River tributaries and allow us to prioritize management actions including flow recommendations.

FUNDING
US Bureau of Reclamation, UDWR, USGS (in-kind)

INVESTIGATORS
Gary P. Thiede, Research Associate, Peter MacKinnon, Researcher, William W. Macfarlane, Researcher
Deanna Strohm, Post-graduate Researcher

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

PROJECT PERIOD
2011-2015

Ecological changes in aquatic communities in the Big Bend reach of the Rio Grande: synthesis and future monitoring recommendations

The Big Bend reach of the Rio Grande is an important region for binational collaboration on ecosystem management and restoration. The river has been degraded over time. In this assessment, we synthesize information on the river ecosystem to describe changes to physical and biological properties and highlight key uncertainties in responses of biotic communities to dynamic physical and chemical conditions. We demonstrate the use of structural equation modeling and provide recommendations for a monitoring program to address future uncertainties. Upstream dams and water use have altered the flow regime substantially, with overall declines in river flow volume, frequency and large-flood magnitude. Spring snowmelt floods no longer occur, channel reset floods occur less frequently, and high-flow dam releases from Mexico are now important. In alluvial reaches of the river, there has been persistent channel narrowing exacerbated by nonnative vegetation that promotes sediment deposition and stabilizes sediment deposits. Water quality has been impacted by reduced flow and upstream land use, with increases in salinity and nutrient levels over time, and periodic occurrence of low oxygen conditions. The changing flow, habitat, and water quality conditions have severely impacted biotic communities. Future efforts to coordinate monitoring can build on this understanding to help guide management and restoration.

FUNDING, US Fish and Wildlife Service
US Geological Survey - UT CFWRU (*in-kind*)

INVESTIGATORS, Brian Laub, Research Associate
Demitra Blythe, M.S. Candidate

FACULTY
Phaedra Budy, USGS, UT CFWRU, USU-WATS, Ecology Center

PROJECT PERIOD
2014-2016

Implementation and monitoring of a science-based restoration and management plan for native fish and riparian vegetation on the San Rafael River, UT

River restoration aims to develop practices that enhance natural processes important for creating and maintaining habitat critical for healthy fish populations and ecosystem function. Based on several years of biological and geomorphic research, we have designed and implemented a process based, experimental, and adaptive restoration plan for the San Rafael River, an extremely water-challenged desert river in southeastern Utah, home to three imperiled native fishes. Activities implemented in 2015 included systematic removal of non-native tamarisk trees, placement of gravel in the river channel, and installation of beaver-dam mimicking structures. Surveys following restoration activities and a series of flood events have indicated some evidence of gravel bar formation due to gravel transport and deposition and bank and bed scouring and filling around beaver dam structures, changes that added additional habitat complexity into the relatively straight, narrow channel. Future monitoring will continue to explore whether habitat gains are maintained or lost over time. The experimental approach has allowed substantial learning about implementing restoration in this desert river system, and will be applicable to restoration projects in other desert rivers.

FUNDING
Bureau of Land Management, UDWR
National Fish and Wildlife Foundation, Utah Watershed Restoration Initiative, BLM, U.S.G.S – UCFWRU (in-kind)

INVESTIGATORS
Brian Laub, Postdoctoral Fellow
Samuel Lyster, M.S. Candidate

FACULTY
Phaedra Budy, USGS, UTCFWRU, USU-Watershed Sciences, Ecology Center
Peter Wilcock, USU-Watershed Sciences

PROJECT PERIOD
2014-2016

Evaluating the potential impact of American white pelican predation on Bonneville cutthroat trout in Strawberry Reservoir, Utah

The recovery of American white pelicans has raised concerns that the birds may impact fisheries. We investigated this potential issue on Strawberry Reservoir, Utah, by estimating the impact of pelicans on Bonneville cutthroat trout in multiple ways. We determined pelican-related mortality using pelican diets and recovered PIT tags, tracking cutthroat trout movements into tributaries, and monitoring pelican activity in order to determine if pelicans influenced fish movements. Greater than 80% of fish consumed by pelicans were non-game Utah sucker, while < 10% of diets consisted of cutthroat trout. Adult cutthroat trout mortality due to pelicans is between 1 – 14%. High pelican activity correlates with decreased trout movement into tributaries; however, residence and migration times are not influenced by pelicans. Additionally, we learned the abundance and behavior of the pelicans is dynamic across space and time. These results present a trade-off in managing the pelicans between losing small numbers of valuable spawning cutthroat trout and removing large numbers of non-game fish.

FUNDING
Utah Division of Wildlife Resources;
US Forest Service, Fish and Aquatic Ecology Unit, Logan, Utah; US Geological Survey–UCFWRU (in-kind);
USU Ecology Center

INVESTIGATORS
Kevin Chapman, Graduate Researcher
Gary P. Thiede, Researcher Associate
Jamie Reynolds, Undergraduate Researcher
Brett Mossman, Undergraduate Researcher

FACULTY
Phaedra Budy, USGS, UTCFWRU, USU-Watershed Sciences, Ecology Center;
Frank Howe, UDWR, USU-Wildland Resources

PROJECT PERIOD
2014-2016

Assessing the state of river science, water resources management policies, and water resources planning tools for the Rio Grande/Rio Bravo

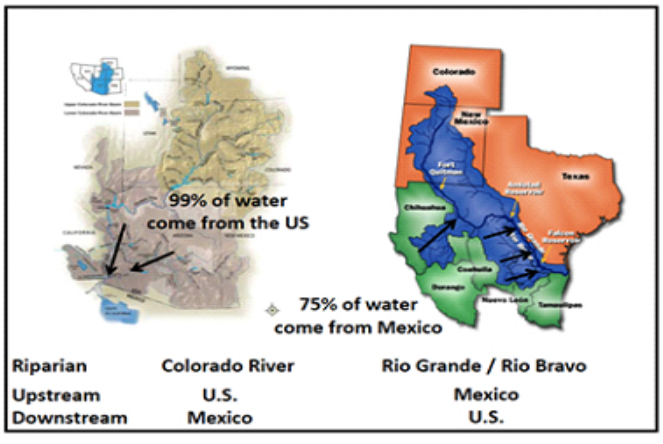
The Rio Grande/Rio Bravo (RGB) is a tightly constrained river system where human demands have the potential to exceed available supplies. Meeting societal needs and also recovering a damaged native river ecosystem is a difficult challenge. Doing so in a bi-national context is even more daunting. This project seeks to assemble and review available scientific monitoring and research reports and papers to synthesize a state-of-river science for the entire RGB. Preliminary review indicates that there is an unequal distribution of research foci, and there are large parts of the watershed for which there is little scientific information, especially about the linkages among physical and ecological processes and human-caused perturbations in those processes. The body of work proposed will communicate the state of RBG science to diverse stakeholders, researchers, and decision-makers, identify information gaps that merit additional research and resources, describe promising future steps to couple and improve existing systems models, and propose ideas to share and serve science syntheses in digital and spatially-explicit databases.

FUNDING
US Geological Survey–South Central Climate Science Center,US Geological Survey–UCFWRU (in-kind)

INVESTIGATORS
Demitra Blythe, M.S. Candidate
Todd Blythe, M.S. Candidate

FACULTY SUPPORT
Phaedra Budy, USGS, UTCFWRU, USU-Watershed Sciences, Ecology Center
Jack Schmidt and Sara Null, USU-Watershed Sciences, Ecology Center
Dr. Samuel Sandoval Solis, University of California, Davis.

PROJECT PERIOD
2015-2017



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 organism's vital rates are essential for tracking and understanding the successful recovery of endangered species. The razorback sucker and the Colorado pikeminnow are federally endangered fishes historically found in the San Juan River which appear to be recovering, however, the degree of improvement is unknown. Passive Integrated Transponder (PIT) tags allow researchers to track movement and estimate vital rates of fish. Recently mobile PIT tag antenna systems have been developed and, though promising, they present new challenges to estimation techniques. Tags, not fish, are detected increasing the chance that shed tags or dead fish with tags are being detected which causes over-estimation of survival. Distance and direction moved between detections are used to classify tags as alive or dead. This information allows us to develop analytical correction rule sets to improve current estimates of survival, etc. These techniques will improve the accuracy and precision of vital rate estimates while providing new habitat selection data and decreasing the resources needed for these results.

FUNDING
Bureau of Reclamation

INVESTIGATORS
Ben Stout, M.S. Candidate

FACULTY SUPPORT
Phaedra Budy, USGS, UTCFWRU, USU-Watershed Sciences, Ecology Center
Mary Conner, USU-Wildland Resources

PROJECT PERIOD
September 2015 - December 2017

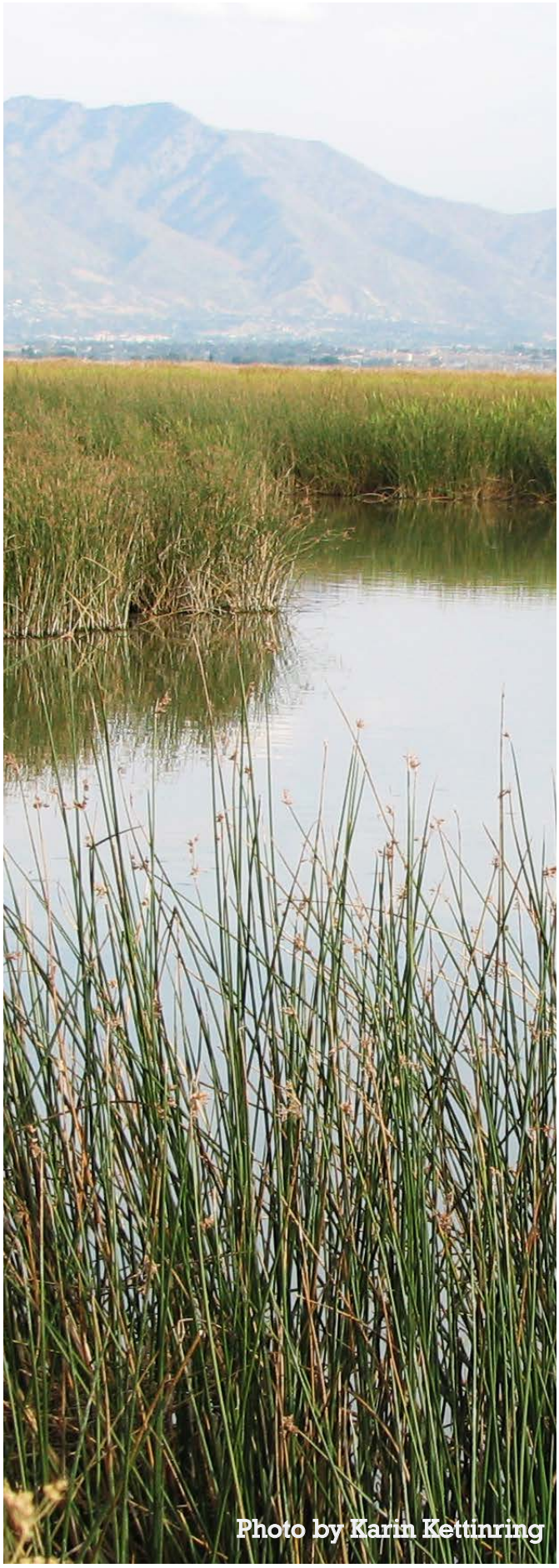


Photo by Karin Kettinring

We wish you all safe & successful research in the coming year!