
2011 ANNUAL REPORT
USGS Biological Resources Division
Utah Cooperative Fish and Wildlife Research Unit
College of Natural Resources
Utah State University, Logan UT 84322-5290



(LEFT) Sam McKay (MS candidate) and Utah Division of Wildlife personnel weigh, measure, and PIT tag Bonneville cutthroat trout in the Weber River, Utah, 2011. (RIGHT) Nick Heredia (MS candidate) with a Lahontan cutthroat trout and a half-digested tui chub in its mouth, caught while pulling in gill nets on Pyramid Lake, NV, 2012.

Presented at the:
2012 Coordinating Meeting
College of Natural Resources
Logan, UT
2 May 2012



COOPERATORS:
USGS Cooperative Research Units Program
Utah Division of Wildlife Resources
CNR Utah State University
Wildlife Management Institute
U.S. Fish & Wildlife Service

2012 Annual Coordinating Committee Meeting Agenda
Utah Cooperative Fish and Wildlife Research Unit
Dean's Conference Room
College of Natural Resources
Utah State University, Logan, UT
Wednesday, 2 May 2012

Rotating Chair: 1992:USU, 1993:NBS, 1994:UDWR, 1995:WMI, 1996:USU, 1997:USGS, 1998:UDWR,
1999:WMI, 2000:USU, 2001:USGS, 2002:UDWR, 2003:WMI, 2004:USU, 2005:USGS, 2006:UDWR, 2007:WMI,
2008:USU, 2009:USGS, 2010:UDWR; 2011WMI; **2012 USU**

Wednesday Evening Social @ 5:00 P.M immediately following the CCM.
at P. Budy and N. Bowes' residence, 456 South 100 West, Providence UT

Openings

0830-0900 Continental Breakfast
0900-0915 Introductions
0915-0930 Unit Finances and Productivity – J. A. Bissonette

a) New faculty and New Initiatives – Phaedra Budy

0930-0945 Sara Null, Assistant Professor, Watershed Sciences
0945-1000 Dan MacNulty, Assistant Professor, Wildland Resources

1000-1015 Working Break

b) New faculty and New Initiatives – Tom Edwards

1015-1030 Kari Veblen, Assistant Professor, Wildland Resources
1030-1045 Rick Krannich, Mark Brunson, and Paul Jakus, the proposed Center for Society,
Economy and the Environment (CSEE)

Cooperator Updates

1045-1145 U.S. Fish and Wildlife Service, Steve Torbitt
Wildlife Management Institute, Chris Smith
Utah Division of Wildlife Resources, Alan Clark et al.
College of Natural Resources, Chris Luecke et al.
Ecology Center, Nancy Huntly
USGS Cooperative Research Units Program, Joe Margraf et al.

1145-1200 Introductions of Students and Their Posters

1200-1330 Catered lunch and Poster Presentations

Unit Transitions

1330-1400 Close-out
1400-1700 Closed meeting, Coordinating Committee

1700- Unit Social - all faculty, staff, and students invited. We will celebrate another good year, focus on the transition of leadership of the Unit, and J.A. Bissonette would like to take this opportunity to thank all of his USU and Agency colleagues, students, and staff he has worked with through the years.

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Escape ramp use on US 89/91 in Wellsville Canyon-- Patty Cramer Photo

W. Carl Saunders (post doctoral fellow) shows off his modified "sluice box" used to divert river debris from experimental fish enclosures in the Right Hand Fork tributary of the Logan River, Utah, while Fish Ecology Lab undergraduate field technicians look on, 2011.

*A sample of 2011 Unit
Research Activities*



Mule deer using escape ramp on route 6, Utah. Patty Cramer Photo



John A. Bissonette
Thomas C. Edwards, Jr.
Phaedra E. Budy

PERSONNEL
COOPERATORS – COORDINATING COMMITTEE

UNITED STATES GEOLOGICAL SURVEY

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**UTAH DIVISION OF WILDLIFE
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UTAH COOPERATIVE FISH AND WILDLIFE RESEARCH UNIT
LEADERS **STAFF**

John A. Bissonette
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Unit Research Staff and Students

Research Associates:



Patricia Cramer, Ph.D.



Mary Conner, Ph.D.



Peter MacKinnon, M.S.



Gary Thiede, M.S.

Graduate Students & Post Docs by Degree Program:

 A portrait of Justin Bingham, a young man with short brown hair, wearing a red and blue baseball cap and a camouflage jacket over a white t-shirt. He is smiling and has a backpack on.	 A portrait of Tracy Bowerman, a woman with long dark hair, wearing a blue jacket. She is smiling.
<p>Justin Bingham, Wildlife Biology - Master's</p>	<p>Tracy Bowerman Aquatic Ecology – Ph.D.</p>
 A portrait of Adam Brewerton, a man with short brown hair and a goatee, wearing a green puffer jacket. He is smiling.	 A portrait of Jacob Gibson, a man with long brown hair and a full beard, wearing a green button-down shirt. He is smiling.
<p>Adam Brewerton Avian Ecology – Master's</p>	<p>Jacob Gibson Landscape Ecology - Master's</p>
 A portrait of Nick Heredia, a man with short brown hair and a goatee, wearing a white baseball cap and a black jacket over a blue t-shirt. He is smiling.	 A portrait of Stephen Klobucar, a man with short brown hair, wearing a brown button-down shirt. He is looking directly at the camera.
<p>Nick Heredia Aquatic Ecology – Master's</p>	<p>Stephen Klobucar Aquatic Ecology - Master's</p>



Sam McKay
Fisheries Biology - Master's



Christy Meredith
Aquatic Ecology – Ph.D.



Daniel Olson,
Wildlife Biology - Ph.D.



Nira Salant
Aquatic Ecology - Post Doc



Carl Saunders
Aquatic Ecology – Master's



David Stoner
Wildlife Ecology – Post Doc



Timothy Walsworth
Aquatic Ecology – Master's



Hillary White
Riparian Ecology - Master's



Lisa Winters
Aquatic Ecology – Master's

Mission Statement
Utah Cooperative Fish and Wildlife Research Unit
2011

The major limiting influences upon fishery and wildlife resources in the Intermountain West are terrestrial habitat degradation and loss and watershed and water issues. Loss of winter range for big game, degradation and impacts on riparian areas by agricultural practices, impacts on wildlife rangeland habitat by practices such as sagebrush removal and the planting of cattle forage, change of reservoir and riverine habitat through activities associated with hydroelectric and water delivery systems as well as the increasing influences of climate change are the major factors that have and will continue to affect natural resource management in Utah in years to come. Rapid population growth in the state has exacerbated the pressures on both the terrestrial and aquatic resource. Given these trends and the expertise of Unit personnel, the primary mission of the Unit is to address food web and habitat related problems relating to the fishery and wildlife resources of Utah and the Intermountain West.

Cooperating Faculty in the Department, College, and University are, and will continue to be, integrated into Unit research to apply diverse expertise to all facets of a research problem. In addition to the more traditional fields of biological endeavor, expertise in geographical information systems, expert systems, artificial intelligence, sociological science, survey methodology, chemical and contaminant analysis, and computer modeling and methodology, as well as other pertinent fields, can be brought to bear on resource problems. The primary motivation of the Unit is to solve pressing resource problems.

Technical expertise of the Unit staff includes: larger scale dynamics, geographical information system and habitat restoration methodology, terrestrial habitat analysis, population management and assessment, aquatic habitat ecology, fish population dynamics, aquatic food web dynamics, and quantitative study design. Our 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. Future research directions of the Unit will continue to involve endangered fish and wildlife species, sustainable game and sport fish management, terrestrial and aquatic riparian studies, migratory non-game bird research, geographical information system methodology, and landscape-level studies involving modeling for future climate scenarios.

Graduate level courses being taught by unit personnel at Utah State University include Design and Analysis of Ecological Research (emphasizes the research process), Topics in Spatial Ecology (emphasizes space from an ecological as well as statistical perspective), Assessment of Fish and Wildlife Populations (emphasizes sampling design and estimation of abundance and survival), and Landscape Ecology (emphasizes the conceptual background of large scale ecology). Unit personnel are involved in continuing education/professional advancement short courses for agency personnel. The Unit is committed to academic pursuit of cooperator interests, and in particular, the needs of the Utah Division of Wildlife Resources. Yet, the strength of the Unit is directly related to its ability to attract outside funds. Research done in the state and region with non-cooperator funds provides added benefits to cooperators. This Unit has and will continue to address resource issues associated with its expertise to the benefit of Utah and the resource management community. Our primary objective is quality science.

UNIT PRODUCTIVITY CY 2011

Publications

Chapters in Books

- Bissonette, J.A. In Press. Chapter 6. The issue of scale in management. Pages xx *In: P.R. Krausman and J.R. Caine, (eds.), Wildlife Management: Contemporary principles and practices. The Johns Hopkins Press, Baltimore, MD, USA.*
- Edwards, T.C., Jr., D.R. Cutler, and K.H. Beard. In Press. Chapter 7. Predicting risk of invasive species occurrence-- plot-based approaches. Pages xx *In: B. Welch, (ed.), Tools for prioritizing, predicting and managing invasive plants on public lands.*
- Edwards, T.C., Jr., D.R. Cutler, and K.H. Beard. In Press. Chapter 9. The process of model assessment and evaluation. Pages xx *In: B. Welch, (ed.), Tools for prioritizing, predicting and managing invasive plants on public lands.*
- Edwards, T.C., Jr., D.R. Cutler, and K.H. Beard. In Press. Chapter 12. Predicting invasive-plant species occurrences in Klamath Network National Parks-A Process for Prioritizing Prevention. Pages xx *In: B. Welch, (ed.), Tools for prioritizing, predicting and managing invasive plants on public lands.*
- McIntosh, A., P.A. McHugh, and P. Budy. 2011. Chapter 24. Brown Trout. *In: Handbook of Global Freshwater Invasive Species (a summary of the current state of knowledge of 30 of the most notable global invasive freshwater species <http://www.earthscan.co.uk/>).*

Peer- Reviewed Papers

- Bolliger, J., T.C. Edwards, Jr., S. Eggenberg, S. Ismail, I. Seidl, and F. Kienast. 2011. Dry grassland meadows of high conservation priority: balancing forest regeneration probabilities and maintenance costs. *Conservation Biology* 25:567-576.
- Budy, P., M.E. Baker, and S.K. Dahle. 2011. Predicting fish growth potential and identifying potential water quality issues: A spatially explicit bioenergetics approach. *Environmental Management*. ISSN 0364-152X; DOI 10.1007/s00267-011-9717-1.
- Budy, P., Seidel, S., Koons, D., and B. Roper. *In Press*. Exploring spawning dynamics and potential limiting factors for the early life stages of native cutthroat trout. *North American Journal of Fisheries Management*. Accepted 7 February, 2012. Manuscript ID: M10-175R.
- Grilo, C., F. Ascensão, M. Santos-Reis, and J.A. Bissonette. 2011. Do well connected landscapes promote road-related mortality. *European Journal of Wildlife Research*. Accepted 25 Nov. 2010. (Online first DOI: 10.1007/s10344-010-0478-6)
- Hansen, E.S., and P. Budy. 2011. The potential of passive stream restoration to improve ecosystem health and minimize the impact of fish disease: a short-term assessment. *Journal of the North American Benthological Society* 30:573-588.
- Larsen, R.T., J.A. Bissonette, J.T. Flinders, and A.C. Robinson. *In Press*. Does small-perimeter fencing inhibit antelope and mule deer use of free water? *Journal of Wildlife Management* 75(6):1417-1425.
- Lobón-Cerviá, J., G. González, and P. Budy. 2011. Factors driving spatial and temporal variation in production and production/biomass ratio of stream-resident brown trout (*Salmo trutta*) in Cantabrian streams. *Freshwater Biology* 56:2272-2287.
- McHugh, P., A. McIntosh, S. Howard, and P. Budy. *In Press*. Niche flexibility and trout-galaxiid co-occurrence in a hydrologically-diverse riverine landscape. *Biological Invasions*: Accepted April 1, 2012. Manuscript ID: BINV2863.
- Meier, E.S., T.C. Edwards Jr, F. Kienast, M. Dobbertin, and N.E. Zimmermann. 2011. Co-occurrence patterns of trees along macro-climatic gradients and their potential influence on

the present and future distribution of *Fagus sylvatica* L. *Journal of Biogeography* 38:371-382.

- Salant, N.L., J.C. Schmidt, P. Budy, P.R. Wilcock. *In Press*. Unintended consequences of restoration: Loss of riffles and gravel substrates following weir installation. *Journal of Environmental Management*. Submitted 18 March, 2011. Manuscript ID: JEMA-D-11-00523.
- Sales-Luis, T., J.A. Bissonette, and M. Santos-Reis. *In Press*. Conservation of Mediterranean otters: the importance of map scale resolution. *Biodiversity and Conservation*. Accepted 31 January 2012.
- Weber, P.A., P. Thompson, and P. Budy. *In Press*. Status and structure of two populations of bluehead in the Weber River, UT. *Southwest Naturalist*. Accepted 31 May, 2011.
- Wilson, T.L., A.P. Rayburn, and T.C. Edwards, Jr. *In Press*. Spatial ecology of refuge selection by an herbivore under risk of predation. *Ecosphere*.
- Wilson, T.L., F.P. Howe, and T.C. Edwards, Jr. 2011. Effects of sagebrush treatments on multi-scale resource selection by pygmy rabbits. *Journal of Wildlife Management* 75:393-398.

Submitted and/or in Revision

- Beard, K.H., C.A. Faulhaber, S.L. Durham, F.P. Howe, and T.C. Edwards Jr. Indirect interactions among rodents and seeds in a shrubsteppe ecosystem. In review, *Journal of Applied Ecology*.
- Bissonette, J.A., and S. Rosa. 2011. A mitigation strategy for deer-vehicle collisions in southern Utah: Evaluation of effectiveness. Revised, resent Feb. 2012, *European Journal of Wildlife Research*.
- Biswas, T., R.D. Ramsey, J.A. Bissonette, and J.Symanzik. Integration of two spectral indices to monitor moist grassland loss within the Jaldapara Wildlife Sanctuary, India. In review, *International Journal of Remote Sensing*.
- Bowerman, T. and P. Budy. Incorporating movement patterns to improve survival estimates for juvenile bull trout. In review, UJFM- 2012-023.
- Bottcher, J.L., and P. Budy. Maintaining population persistence in the face of an extremely altered hydrograph: Implications for imperiled desert fishes. In revision, *Biological Conservation*. Ms. ID: 11-1920.
- Bottcher, J.L., T.E. Walsworth, G.P. Thiede, P. Budy, and D. Speas. Tributary usage by the endangered fishes of the upper Colorado river basin: A case study from the San Rafael River, UT. In revision, *North American Journal of Fisheries Management*, Management Brief. Ms. ID: UJFM-2011-0212.
- Budy, P., G.P. Thiede, A. Dean. D. Olsen, and G. Rowley. A comparative and experimental evaluation of the performance of diploid and triploid brooks trout. Submitted 6 February 2011, In revision, *North American Journal of Fisheries Management*, Ms. ID: UJFM- 2012-0027.
- Budy, P., G.P. Thiede, J. Lobon-Cervia, G. Gonzales, A. Vollestad, A. McIntosh and P. A. McHugh.. Limitation and facilitation of one of the world's most invasive fish: an intercontinental comparison. In review, re-submitted 19 April, 2012, *Ecology*, Ms. ID: 11-1920 R.
- Edwards, Jr., T.C., 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*.

- Norevll, R.E., T.C. Edwards, Jr., and F.P. Howe. Disturbance as restoration in shrubsteppe: mixed effects on non-target bird species. In review, *Journal of Applied Ecology*
- Saunders, W.C., P. Budy, and G. Thiede. Evaluation of demographic change following two years of mechanical removal of exotic brown trout *salmo trutta* in an Intermountain West (USA), high-elevation stream. Submitted 30 November, 2011, in revision *North American Journal of Fisheries Management* Ms. ID: UJFM- 2011-0230.
- Walsworth, T.E., and P. Budy. A modeling approach to prioritizing restoration activities for an ecological complex of imperiled desert fishes. Submitted 11 December 2011, in review *Conservation Biology* Ms. ID: 11-826.
- Walsworth, T.E., P. Budy, and G.P. Thiede. Longer food chains and crowded niche space: effects of multiple invaders on imperiled desert fishes. Submitted: 16 Jan. 2012, in review, *Freshwater Biology*, Manuscript ID: FWB-P-Jan-12-0036.

Technical Reports

- Bestgen, K.R., Budy, P. and W.J. Miller. 2011. Status and trends of flannelmouth sucker *Catostomus latipinnis*, bluehead sucker *Catostomus discobolus*, and roundtail chub *Gila robusta*, in the Dolores River, Colorado, and opportunities for population improvement: Phase II Report. Final report submitted to the Lower Dolores Plan Working Group-Legislative Committee. Larval Fish Laboratory Contribution 166 and Intermountain Center for River Rehabilitation and Restoration 2011(2): 1-55, + appendices.
- Budy, P., G.P. Thiede, W.C. Saunders, and C. Meredith. 2011. Logan River whirling disease study: factors affecting trout population dynamics, abundance, and distribution in the Logan River, Utah. 2010 Annual Report to Utah Division of Wildlife Resources. Sport Fish Restoration, Grant number XIII. Project F-47-R. UCFWRU 2011(2):1-36.
- Budy, P., L.B. Tennant, T. Bowerman, and G.P. Thiede. 2011. Bull trout population assessment in northeastern Oregon: a template for recovery planning. 2010. Annual Progress Report to US Fish and Wildlife Service. UCFWRU 2011:1-88.
- Budy, P. and N.L. Salant. 2011. Native fish status and trends and opportunities for improvement on the Lower Dolores River: Phase I. Report submitted to the Dolores River Dialogue Steering Committee. ICRRR 2011(1):1-48.

Popular Articles

- Leavitt, S. 2011. A Race against the clock: Can Piñon-Juniper woodlands migrate fast enough? *The Wildlife Professional* Fall 2011 Special Edition: *Climate Change*. 5(3):47-49.

Students Directed

Theses and Dissertation Completed

J.A. Bissonette

- White, Hillary. 2011. Developing riparian bird habitat association models and management guidelines. M.S. Thesis, Utah State University.
- Sales Luís, Teresa. 2012. Niche breadth and patterns of distribution and abundance of Eurasian otters in southern Portugal: Conservation implications, Ph.D. Dissertation, University of Lisbon (Co-chair with Dr. Margarida Santos Reis)

T.C. Edwards

- Gibson, J.R. 2011. Individualistic responses of piñon and juniper distributions to projected climate change. M.S. Thesis (Ecology), Utah State University.

P. Budy

Walsworth, Timothy. 2011. A patch approach to understanding the effect of stream degradation on food web and population structure of imperiled desert fishes. MS Thesis (Ecology), Utah State University.

Meredith, Christy. 2012. Effects of a changing physical template on the longitudinal distribution of brown trout in a mountain stream: implications for brown trout invasion success. Ph.D. Dissertation (Ecology), Utah State University.

Active Graduate Research Projects

J.A. Bissonette

Olson, Dan., Ph.D. Modeling population effects of deer vehicle collisions. Expected completion December 2013.

T. C. Edwards

Brewerton, A., M.S. Avian response to post wildland fire reseeding treatments in Great Basin shrubsteppe. Expected completion May 2012.

P. Budy

Bowerman, Tracy., Ph.D. (Aquatic Ecology) Understanding the effects of land use and natural variation in habitat on early life-history of threatened bull trout. Expected completion 2012.

Klobucar, Stephen. M.S. (Aquatic Ecology) An experimental and modeling approach to predator-prey dynamics: identifying limitations of predator performance in high desert impoundments. Expected completion September 2012.

Chaston, Reed. M.N.R. Managing fish populations with links to water quality. Expected completion September 2012.

Heredia, Nick., M.S. (Aquatic Ecology) Evaluating cutthroat trout performance and identifying limiting factors for the native fish community. Expected completion January 2013.

Winters, Lisa. M.S. (Aquatic Ecology) An investigation of the relative roles of interspecific interactions and forage production on the growth and survival of three trout predators in Scofield Reservoir, UT. Expected completion September 2013.

McKay, Samuel. M.S. (Aquatic Ecology) Towards a better understanding of the historical and contemporary importance of mainstem connectivity and tributaries; a meta-population approach to maintaining population viability of native trout. Expected completion September 2013.

Klobucar, Stephen. M.S. Can morphology, productivity, and biotic community diversity predict fish production potential across a diversity of lentic systems? Expected completion September 2012.

Active Undergraduate Research Projects

P. Budy

Christian T. Smith. 2011-12. Application of otolith aging to determine differences in size structure and growth rates of smallmouth bass in the green and Yampa Rivers in Dinosaur National Monument. Watershed Sciences, USU.

Wes Gordon. 2011. Effects of large-scale removal of brown trout (*Salmo trutta*) on the diet and condition of trout in Right Hand Fork. Watershed Sciences, USU.

Konrad Hafen. 2011. Do small impoundments serve as a source for rapid recolonization of riverine habitat after large-scale removal of exotic brown trout (*Salmo trutta*) from the Logan River? Wildlife Resources, USU.

Active Post-doctoral Fellows Mentored

P. Budy

Salant, Nira. 2009- present. Advancing the science and practice of river restoration. Intermountain Center for River Rehabilitation and Restoration. Co-Advised with Jack Schmidt.

W. Carl Saunders. 2010- present. A test of the theory of biotic resistance: novel options for native fish restoration.

T. C. Edwards

Stoner, D. 2011-present. Spatial responses to climate across trophic levels: monitoring and modeling plants, prey, and predators in the Intermountain Western United States.

Presentations

Invited

Bissonette, J.A. 2012. Landscape metrics: understanding larger scale measurement. Lecture/lab class given at U. Lisbon Portugal, 7 March 2012, 27 undergraduate students,

Bissonette, J.A. 2012. Understanding the natural world: why you cannot believe what you see, hear or read. Invited Public Lecture presented at Instituto Camões, Rua Rodrigues Sampaio, 113, Lisbon Portugal. Portuguese Fulbright Lecture Series, 13 March 2012.

Bissonette, J.A. 2012. Visualizing landscape pattern: changing views, scale sensitivity, and landscape connectivity. Invited Public Lecture, given at the Open University of Cyprus, Nicosia, Cyprus, 4 April 2012. Audience: 20 Government, NGOs, Universities,

Bissonette, J.A. 2012. Roaded landscapes: Foundation concepts and practical approaches. Invited Seminar, given at the Open University of Cyprus, Nicosia, Cyprus, 7 April, 2012. Audience: 30 Faculty and Students.

Bissonette, J.A. 2012. New developments in fragmentation research: Partitioning habitat loss from habitat configuration. Invited seminar given at U. Lisboa, Portugal, 11 April 2012.

Budy, P. 2011. Evidence linking delayed mortality of snake river salmon to their earlier hydrosystem experience. Comparative Survival Study Workshop, Silverton, OR. 26 July 2011.

Edwards, T.C., Jr. Modelling contraction and expansion zones of piñon pines and junipers in Western North America under projected climate change scenarios. University of Tromsø, Tromsø, Norway, 27 May 2012.

Edwards, T.C., Jr., F. Kienast, and J. Bolliger. The effectiveness of agro-environmental conservation programs in maintaining high alp meadow biodiversity. 2011 Meeting of the U.S. Chapter of the International Association for Landscape Ecology, Portland, OR, 4 April 2011.

Edwards, T.C., Jr., J.R. Gibson, G.G. Moisen, T.S. Frescino, and N.K. Zimmermann. Effects of projected climate change on hybridization zones of piñon pines and junipers of Western North America: An evolutionary perspective. USGS Climate Change Seminar Series, Reston, VA, 19 January 2011.

Kienast, F., T.C. Edwards, Jr., K.B. Jones, and L.S. Morán. Mapping landscape functions at large scales: Europe, United States, and Mexico. The 8th International Association for Landscape Ecology, Beijing, China, 19 August 2011.

Kienast, F., T.C. Edwards, Jr., M. Potschin, and R. Haines-Young. Generating large-scale maps featuring the capacity of landscapes to deliver ecosystem goods and services. 2011 Meeting of the U.S. Chapter of the International Association for Landscape Ecology, Portland, OR, 4 April 2011

Saunders, W.C., P. Budy, P. Burnett, and P. Holden. 2011. Can a university, the UDWR, the U.S. Forest Service, and a Trout Unlimited chapter really accomplish anything? Biological Restoration of the Right Hand Fork of the Logan River, an Experiment. American Fisheries Society, Utah Chapter, 22-23 March 2011. Salt Lake City, UT.

Contributed

- Brewerton, A.B., and T.C. Edwards, Jr. Avian response to post wildland fire reseeding treatments in Great Basin shrubsteppe. 18th Annual Conference of The Wildlife Society, Kona, HI, 6 November 2011.
- Bowerman, T. and P. Budy. 2011. How do habitat connectivity and dispersal rates affect population dynamics of an imperiled freshwater fish? Poster presentation, Spring Runoff Conference, Logan, UT, 29-30 March 2011.
- Bowerman, T., P. Budy., and B.T. Neilson. 2011. Effects of substrate size, hyporheic flow, and spawning site selection on bull trout egg and alevin survival. American Fisheries Society Annual Meeting, Seattle, WA, September 8 May 2011
- Budy, P. Towards a better understanding of the factors that limit and facilitate one of the world's most invasive fishes: What can we learn from an intercontinental comparison? USU Department of Watershed Sciences and Water Initiative Joint Seminar Series. Logan, UT, 24 February 2011.
- Budy, P. and N. Salant. 2011. Native fish population status and trends and opportunities for improvement on the Lower Dolores River: Phase I. San Juan Citizens Alliance, Lower Dolores River Working Group, Cortez, CO, 6-7 April 2011.
- Edwards, T.C., Jr., J. R. Gibson, G. G. Moisen, and T.S. Frescino. Forecasting climate-induced distribution shifts for the pinyon- juniper complex of the Western U.S. 2011 Meeting of the U.S. Chapter of the International Association for Landscape Ecology, Portland, OR, 6 April 2011.
- Gibson, J.R., G.G. Moisen, T.S. Frescino, and T.C. Edwards, Jr. Contraction and expansion tension zones in Western North America piñon-juniper woodlands under projected climate change. The 11th Biennial Conference of Research on the Colorado Plateau, Flagstaff, AZ, 26 October 2011
- Klobucar, S.L., P. Budy, and G.P. Thiede. 2011. Out of place predators: Using bioenergetic efficiency to explain predator performance across an array of small impoundments in northeast Utah. American Fisheries Society Annual Meeting, Seattle, WA, September 8 May 2011.
- Saunders, W.C., P. Budy, and G. Thiede. 2011. Using Large-Scale Population Manipulation to Understand Source-Sink Dynamics of Invasive Brown Trout. American Fisheries Society Annual Meeting, Seattle, WA, September 8 May 2011.
- Walsworth, T., P. Budy, and G. Thiede. 2011. Crowded niche space: the impact of novel competitors and predators on the growth rates of endemic desert fishes. American Fisheries Society Annual Meeting, Seattle, WA, September 8 May 2011.
- Walsworth T., P. Budy, and G.P. Thiede. 2011. Degraded habitat and crowded niche space: understanding impacts of habitat loss and non-native fishes on endemic, riverine desert fishes. Spring Runoff Conference, Logan, UT, 29 March 2011.
- Wilson, T.L., and T.C. Edwards, Jr. Navigating the methodological landscape: modeling detection in space. 2011 Meeting of the U.S. Chapter of the International Association for Landscape Ecology, Portland, OR, 5 April 2011.

- Olson, D. D. and J. A. Bissonette. 2012. Tracking wildlife-vehicle collisions in Utah with smartphone technology. Utah Chapter of the Wildlife Society Annual Meeting, Springdale, UT, 21 March 2012.
- Olson, D. D. and J. A. Bissonette. 2012. Assessing the impacts of roads on mule deer in Utah. Utah Chapter of the Wildlife Society Annual Meeting, Springdale, UT, 21 March 2012.
- Olson, D. D., J. A. Bissonette, M. C. Schwender, P. C. Cramer. 2011. A smartphone application for reporting wildlife vehicle collisions. The Wildlife Society Annual Conference, Waikoloa, HI, 1-5 November 2011.

Organized Symposia

- Kienast, F., O. Bastian, and T.C. Edwards, Jr. Landscape services in a changing environment. The 8th International Association for Landscape Ecology, Beijing, China, 19 August 2011. 6 Speakers.
- Edwards, T.C., Jr., and F. Kienast. Modelling landscape Functions under scenarios of global change. 2011 Meeting of the U.S. Chapter of the International Association for Landscape Ecology, Portland, Oregon, 4 April 2011, 7 Speakers.

University Courses

J.A. Bissonette

WILD 6710-7710, Wildlife Ecology (Spring 2011, 13 students)

T. C. Edwards

WILD 6500, Biometry, Utah State University (Fall 2011, 24 students)

WILD 6510, baseR for Biologists, Utah State University (Fall 2011, 28 students)

Workshops

J. A. Bissonette

Landscape Ecology and Genetics Short Course at the University of Lisbon, Portugal (with Dr.

Carlos Fernandes, Centro de Biologia Ambiental), 22-23, and 25-29 July 2011. 13 students.

Visiting Professor at Albert-Ludwigs-Universitaet (Freiburg, Germany) three week short course in landscape ecology, 7-25 November 2011. 24 students.

Landscape Ecology Workshop, 23 January – 2 February 2012 as part of Portuguese Fulbright, University of Lisbon. 13 Ph.D. students.

Drivers of Landscape Change, 6 week class, 9 February – 11 March 2012 as part of Portuguese Fulbright, University of Lisbon. 9 Ph.D. students.

T. Edwards

Co-Instructor, ECOCHANGE: Predictive habitat distribution models: tools for building projections of global change impact on biodiversity. Swiss Federal Research Lab WSL, Lausanne, Switzerland, 16-17 February 2011. 31 students

Outreach and Distance Education

Invited Public Presentations

P. Budy

Saunders, W.C., P. Budy, G. Thiede. 2011. Brown trout demographics in the Logan River: effects of mechanical removal and potential for biotic resistance limit brown trout expansion. Cache Anglers Chapter of Trout Unlimited Logan, UT. 10 January 2011.

Budy, P. 2011. Long term monitoring of trout on the Logan River: Why is monitoring important? UDWR--Blue Ribbon Fisheries Advisory Council. Utah Division of Wildlife Resources, Salt Lake City, UT. 10 March 2011.

Invited External Thesis and Dissertation Examiner

J. A. Bissonette

Vetter, Daniela. 2010 (begin) Effects of tropical forest fragmentation on vertebrates, University of Freiburg, Freiburg, Germany. (Ph.D.)

Glatthaar, Libby Bickford. 2010 (begin). The effect of landscape fragmentation on the dispersal behaviour, demographie, population genetics and species diversity of the small mammals of the Black Forest. Faculty of Forest and Environmental Sciences, Wildlife Ecology and Management Department, University of Freiburg. (Ph.D.)

T. Edwards

Meier, E.S. 2011. Modelling spatial dynamics of plant distributions: implementation of biotic interactions and migration improves large-scale projections of species distributions during climate and land-use change. Ph.D. Dissertation, University of Zurich ETH, Zurich, Switzerland, 20 June 2011.

Professional Service

J.A. Bissonette

Reviewer for: many journals

Editorial Board: European Journal of Wildlife Research, 2003-present

Coordinating Editor: Landscape Ecology, 2008-2011

Member: TWS 75th Anniversary Celebration Committee

Member: TWS 4th International Wildlife Management Congress, 2012

International Review Panel for selection of Landscape Ecology Faculty at Albert Ludwigs Universitaet (U. Freiburg, Germany), April 2012

T.C. Edwards

Reviewer for: Journal of Wildlife Management, Condor, Conservation Biology, Ecology, 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

Editorial Board: 2010-current, Ecography

Secretary General: 2011-current, International Association of Landscape Ecology

Lead: Bureau of Land Management Rapid Ecoregion Assessment Project, Colorado Plateau Ecoregion, BLM, National Operations Center, Denver, Colorado.

P. Budy

Reviewer for (2011): BioScience, Journal of Freshwater Ecology, North American Journal of Fisheries Management, Journal of Fish Biology, Environmental Management, Ecology of Freshwater Fish.

Member: USFWS Bull Trout Research, Monitoring, and Evaluation Tech Team, 2003-present

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

Assistant Director, Intermountain Center for River Rehabilitation and Restoration, Utah State University. 2006 – 2011.

Science Panel Member and Invited Presenter, Comparative Survival Study (Columbia River Salmon - Hydrosystem) Workshop, Silverton, OR, July 26-28, 2011.

Scientific Expert, Lake Trout Suppression Workshop II. The Yellowstone Lake Crisis: Confronting a Lake Trout Invasion. An Interim Scientific Assessment. Chico Hot Spring Resort, MT, June 14-16, 2011.

Invited Expert External Review. NFWF Stream Restoration Review of ³Promoting Successful Restoration through Effective Monitoring in the Chesapeake Bay Watershed. Draft Report prepared for National Fish and Wildlife Foundation. May 15 June 1, 2011.

Research

J. A. Bissonette

- 2006-2011 Riparian bird habitat models and habitat guidelines (Co-PI).
- Utah Division of Wildlife Resources \$130,850. COMPLETED 3/24/11.
- 2009-2013 Modeling population effects of deer vehicle collisions, (PI)
- Utah Division of Wildlife Resources \$269,610, UDOT-AGRC \$30,000
ONGOING

T. C. Edwards

- 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 ONGOING
- 2010-2012 Colorado Plateau Rapid Ecoregional Assessment (Co-PI)
-Bureau of Land Management, \$127,300 ONGOING
- 2009-2012 Avian response to post wildland fire reseeded treatments in Great Basin shrubsteppe (PI)
-Utah Division of Wildlife Resources, \$107,100 ONGOING
- 2009-2011 Sustainable communities and landscape designs (PI)
-U.S. Geological Survey, \$349,500 ONGOING
- 2009-2011 Effects of projected climate change on distribution patterns of Western North America conifers (PI)
-USDA Forest Service, Rocky Mountain Research Station, \$125,000 ONGOING
- 2009-2012 Assessing the importance of biotic interactions for predicting the impact of climate change on the future distribution of plant assemblages (Co-PI)
-Swiss National Science Foundation, \$425,000 CHF COMPLETED
- 2007-2011 ECOCHANGE: Challenges in assessing and forecasting biodiversity and ecosystem changes in Europe (Co-PI)
-European Union (funded through Swiss Federal Research Lab WSL, Birmensdorf, Switzerland), \$7,000,000€ (\$713,170€WSL) COMPLETED

P. Budy

- 2007-2011 Habitat needs, movement patterns, and vital rates of endemic Utah fishes in a tributary to the Green River, Utah. Bureau of Reclamation Primary (BOR), UDWR Secondary. Total Award \$292,474.
- 2011-2014 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 \$344,769.
- 2011-2013 Predator Prey Interactions in Scofield Reservoir, UT. Phaedra Budy (PI), Utah State University, UDWR, Sport Fisheries Research, 2011-2013, Year1 Award \$67,379.
- 2011-2013 Weber River Metapopulation Structure and Source Sink Dynamics of Native Trout. Phaedra Budy (PI), Utah State University, UDWR, Sport Fisheries Research, 2011-2013, Year1 Award \$30,745 direct.

- 2011-2013 Tributary habitat use of endangered and imperiled fishes in the Price River, Utah. Phaedra Budy (PI). Bureau of Reclamation (BOR), Activities to Avoid Jeopardy Program (BOR), Total Award to date \$123,867.
- 2010-2012 NSF: WSC- Category 1: Hydrologic and Ecological Impacts of Changes in Human Water Resource Management in Response to Climate Change and Urbanization. D. Jackson-Smith and 15 others, Total Award, \$149,943.
- 2010-2012 Evaluating fish growth and production potential across Ute Reservation reservoirs. Phaedra Budy (PI), Department of Watershed Sciences. The Ute Indian Tribe, Uintah and Ouray Reservation, Total Award \$100,951.
- 2010-2012 NonPoint Source Program Evaluation: Solicitation AR10167. State of Utah Co:PI with Mesner, Jackson-Smith, and Stevens, State of Utah, Total Award \$149,821.
- 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, Total Award to date \$605,300.
- 2010-2011 An evaluation of a large-scale restoration effort for Bonneville cutthroat trout in Righthand Fork following non-native brown trout removal: towards a better understanding of restoration options for imperiled native fishes. Phaedra Budy (PI), Utah State University, UDWR - Endangered Species Mitigation Fund, \$39,154 and UDWR - Blue Ribbon \$35,000.
- 2010-2011 A test of the biotic resistance hypothesis with native and exotic trout assemblages in Intermountain West stream ecosystems: towards a better understanding of native trout restoration options. Principal Investigator: Phaedra Budy, Utah State University, USGS Western Region: State Partnership Program, \$35,000.
- 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. 2011 = 127,962, US Fish and Wildlife Service (USFWS), Total Award \$1,228,687.

Recognition and Awards

Leaders:

J. A. Bissonette

Senior Fulbright Scholar, University of Lisbon 15 January – 15 April 2012, with a sponsored Inter-Country visit to the Open University of Cyprus, 1-8 April 2012

Cooperative Research Units Recognition Star Award, US Department of Interior CRU, 2011

T.C. Edwards

Cooperative Research Units Recognition Star Award, US Department of Interior CRU, 2011

P.Budy

Cooperative Research Units Recognition Star Award, US Department of Interior CRU, 2011

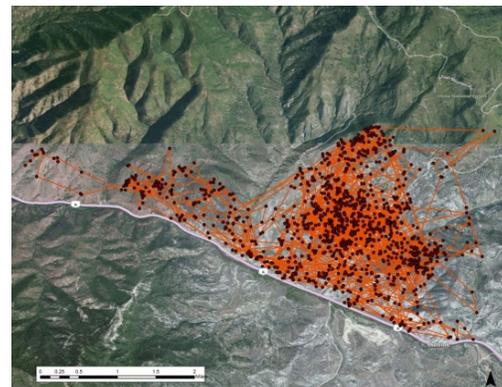
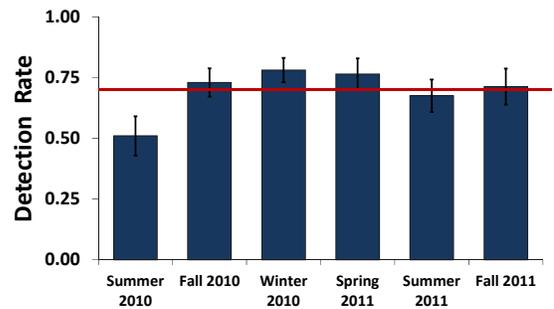
Assessing Vehicle-Related Mortality of Mule Deer in Utah

Dates:

2009-2013

Abstract:

This project was designed to examine the effects of roads on mule deer in Utah. Our research questions include: 1) how many deer are being hit on Utah's highways? 2) what demographic groups are most affected by vehicle-related mortality?, 3) how are movements and survival of deer affected by roads, 4) how is population growth affected by vehicle-related mortality? To estimate the number of deer killed by vehicles, we conducted driving surveys. The detection rate for deer carcasses using driving surveys was 0.73 (Fig. 1). We determined demographic effects by examining >1200 deer carcass. We found that 65% of all deer killed were female and 41% of all deer killed were adult females. To document survival and movements, we captured 32 adult female deer in the highway 6 corridor. Survival was 0.93 (95% CI = 0.78-0.98) for the first year of the study. Figure 2 provides an example of how deer movements can be impacted by roads with high traffic volumes. To examine the effects of vehicle-related mortality, we are developing a density dependent, stochastic matrix model. We also created a reporting system for wildlife-vehicle collisions using smartphone technology that is being used throughout the state.



Top: Detection rate of mule deer carcasses using driving surveys. Bottom: Movement locations of one adult female mule deer highlighting the barrier effect of roads

Funding

Utah Division of Wildlife Resources, Utah Department of Transportation
S. J. Quinney Foundation

Investigators:

John A. Bissonette, Principle Investigator, U.S. Geological Survey UTCFWRU and Wildland Resources Department
Daniel D. Olson, Graduate Research Assistant (Ph.D.)

Reports and Publications:

Bissonette, J. A. and D. D. Olson. February 2012. The effects of roads on mule deer in Utah: 2011 Annual Report. Pp.21
Green, A., P. C. Cramer, D. D. Olson, and M. S. Schwender. 2012. From road kill to road wise: Utah's effort to reduce mule deer mortality along highways. 2012. Mule Deer Foundation Magazine, January/February Conservation Issue.

Presentations:

Olson, D. D. and J. A. Bissonette. 2012. Tracking wildlife-vehicle collisions in Utah with smartphone technology. Utah Chapter of the Wildlife Society Annual Meeting, Springdale, Utah.
Olson, D. D. and J. A. Bissonette. 2012. Assessing the impacts of roads on mule deer in Utah. Utah Chapter of the Wildlife Society Annual Meeting, Springdale, Utah.
Olson, D. D., J. A. Bissonette, M. C. Schwender, P. C. Cramer. 2011. A smartphone application for reporting wildlife vehicle collisions. The Wildlife Society Annual Conference, Waikoloa, Hawaii.

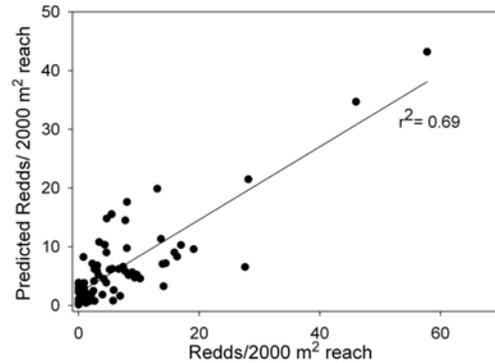
Effects of a Changing Physical Template on the Longitudinal Distribution of Brown Trout In a Mountain Stream: Implications for Brown Trout Invasion Success

Dates:

2008-2012

Abstract:

In this research, we investigated potential factors influencing the Logan River brown trout distribution, including scouring of brown trout fry during the spring flood, gravel availability, temperature, and the availability of sculpin prey. Our results show that brown trout fry at high elevations are not more susceptible to scour during the spring flood, compared to fry at lower elevations. However, brown trout fry at high elevations may be more susceptible to displacement because a greater percentage of fry are still in the gravel during the flood. In a model of potential factors influencing brown trout spawning densities, the most informative predictive variables were the presence of anchor ice as a barrier to movement upstream, average temperature, and gravel availability. At low elevations, sculpin were present in high densities and comprised a large proportion of the brown trout diet. Our results illustrate that a combination of factors may contribute to low abundance of brown trout at high elevations, possibly related to lower temperatures and the availability of habitat for spawning. In addition, brown trout growth and condition at low elevations may be positively influenced by the high availability of sculpin prey.



Funding and Collaborators:

Utah Division of Wildlife Resources, US Geological Survey – UCFWRU (in-kind), Intermountain Center for River Rehabilitation and Research (ICRRR), US Forest Service

Investigators:

Phaedra Budy, USGS – UCFWRU, USU – Watershed Sciences
Christy Meredith, PhD Student, USU, Watershed Sciences
Jack Schmidt, USU and ICRRR

Selected Publications:

Wood, J. and P. Budy. 2009. An investigation of the early life-history and potential influences on invasion success of exotic of brown trout (*Salmo trutta*). Transactions of the American Fisheries Society 138:756-767.

Bull Trout Survival and Movement in the Mid-Lower Walla Walla River, Washington: Understanding the Role of Environmental Stressors and Signals.

Dates:

2012-2014

Abstract:

Resource managers need to understand the interactions between a species and its environment to inform recovery actions for Threatened and Endangered Species. The goal of this project is to determine how environmental covariates influence bull trout survival in the Middle and Lower Walla Walla River. To accomplish this goal we will 1) compile existing environmental covariate data, 2) determine where data gaps exist and collect information to fill data these gaps, and 3) conduct a spatial analysis of environmental covariates and bull trout movement and survival. Combining the bull trout survival, movement, and habitat data that we have collected for the last 10 years with targeted new information will allow us to inform bull trout recovery efforts in the Walla Walla River Basin and throughout their range.



Funding:

U.S. Fish and Wildlife Service (USFWS)
U.S. Geological Survey – UCFWRU (*in-kind*)

Investigators:

Phaedra Budy, Principle Investigator, US Geological Survey – UCFWRU, USU- Department of Watershed Sciences
Howard A. Schaller, Project Leader, USFWS - Columbia River Fisheries Program Office
Courtney Newlon, Graduate Research Assistant, USFWS, USU – Department of Watershed Sciences (expected graduation, 2014)

Selected Publications:

Homel, K. and Budy, P., 2008. Temporal and spatial variability in the migration patterns of juvenile and subadult bull trout (*Salvelinus confluentus*) in Northeast Oregon. Transactions of the American Fisheries Society 2088: 137: 869-880.

Al-Chokhachy, R., and P. Budy. 2008. Demographic characteristics, population structure, and vital rates of a fluvial population of bull trout in Oregon. Transactions of the American Fisheries Society 137:262-277.

Reports:

Budy, P., T. Bowerman, and G.P. Thiede. Bull trout population assessment in northeastern Oregon: a template for recovery planning. 2010 Annual Report. UCFWRU 2011.

Bull Trout Population Assessment in Northeastern Oregon: A Template for Recovery Planning.

Dates:

2002-2012 (ongoing)

Abstract:

The goal of this project is to provide data and conservation assessment tools to aid the U.S. Fish and Wildlife Service's efforts to determine management actions necessary for recovery of bull trout, a species listed as Threatened under the Endangered Species Act. Each summer, researchers systematically capture and mark bull trout with unique tags and then re-sight marked individuals during subsequent sampling events at various locations throughout the watershed. Additional resights occur at passive in-stream antenna arrays, located throughout the river system, which allows us to track movement of marked fish. Collecting data on several populations across consecutive years has allowed us to provide critical information on bull trout abundance, trend, vital rates, habitat needs, and movement patterns, and compare how these vary between different life-stages. Data from this study is currently being used to help build a population viability model to assess how elimination of current threats can help protect bull trout populations across the species' range.



Funding:

US Fish and Wildlife Service, US Geological Survey - Utah Cooperative Fish and Wildlife Research Unit (in-kind)

Investigators:

Phaedra Budy, Principle Investigator, USGS – UCFWRU, USU- Dept. of Watershed Sciences
Gary P. Thiede, Fishery Biologist, USU- Dept. of Watershed Sciences
Tracy Bowerman, Graduate Research Assistant (PhD), USU- WATS
{expected graduation, 2012}

Selected Publications:

Al-Chokhachy, R. and P. Budy. 2008. Demographic characteristics, population structure, and vital rates of a fluvial population of bull trout in Oregon. *Transactions of the American Fisheries Society* 137: 1709:1722.

Al- Chokhachy, R., P. Budy, and M. Conner. 2009. Detecting declines in the abundance of a bull trout (*Salvelinus confluentus*) population: understanding the accuracy, precision and costs of our efforts. *Canadian Journal of Fisheries and Aquatic Sciences* 66: 649-658.

Reports:

Budy, P., L. B. Tennant, T. Bowerman, and G.P. Thiede. 2011. Bull trout population assessment in northeastern Oregon: a template for recovery planning. 2010 Annual Progress Report to US Fish and Wildlife Service. UTCFWRU 2011 (5):1-90.

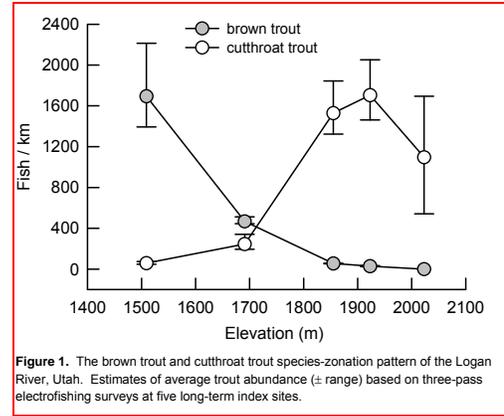
Logan River Trout Viability and Long-Term Monitoring: Factors Affecting Trout Population Dynamics, Abundance, and Distribution in the Logan River, Utah.

Dates:

2001-2012 (on-going)

Abstract:

Most subspecies of cutthroat trout *Oncorhynchus clarkii* are imperiled or extinct due to the combined effects of habitat degradation and interactions with exotic species. To quantify abundance and vital rates and evaluate trends, we selected a large population of Bonneville cutthroat trout *O. clarkii* utah from the Logan River of northern Utah, a river characterized by high-quality and connected habitat. Over a 11-year period, we completed a comprehensive population assessment, including depletion-based abundance estimates and a mark-recapture study (several thousand tagged fish) of site fidelity, growth, and survival. Abundance of Bonneville cutthroat trout (> 100 mm TL) varied greatly by sample site, ranging from 38 fish/km at the Third Dam site (the lowermost end of their distribution in the river) up to 822 fish/km at Franklin Basin. Population trend (λ) of cutthroat trout estimated for the entire Logan River population based on pooled site abundance estimates was 0.89 (0.77 – 1.02), indicating an apparent overall decline; however, site-specific population trends are highly variable. Clinical signs of whirling disease were observed in only 1% of fish handled ($n > 10,000$ fish), while prevalence of *Myxobolus cerebralis* in cutthroat trout was 50 – 100%. The distribution of cutthroat trout and brown trout show a distinct species-zonation pattern (Figure 1). Our results provide important conservation and recovery benchmarks for identifying range-wide limiting factors of Bonneville cutthroat trout. We continue to recommend a precautionary approach to the management of this endemic and important population.



Oncorhynchus clarkii

Funding:

Utah Division of Wildlife Resources, US Geological Survey – UCFWRU (*in-kind*), Numerous partners!

Investigators:

Phaedra Budy, Principle Investigator, USGS- UCFWRU, USU-Dept. of Watershed Sciences
Gary P. Thiede, Fisheries Biologist, USU-WATS. W. Carl Saunders, Post-doctoral Fellow, USU-WATS, Christy Meredith, Graduate Research Assistant (PhD), USU-WATS {expected graduation, 2012}

Selected Publications:

Budy, P., G.P. Thiede, P. McHugh. 2007. A quantification of the vital rates, abundance, and status of a critical population of endemic cutthroat trout. *North American Journal of Fisheries Management* 27:593-604.
Budy, P., G.P. Thiede, P. McHugh, E.S. Hansen, and J. Wood. 2008. Exploring the relative influence of biotic interactions and environmental conditions on the abundance and distribution of exotic brown trout (*Salmo trutta*) in a high mountain stream. *Ecology of Freshwater Fish* 17:554-566.

Evaluating Cutthroat Trout Performance and Identifying Limiting Factors for the Native Fish Community of Pyramid Lake, NV.

Dates:

2011-2014

Abstract:

Understanding aquatic food webs is important for both conservation and economic purposes. In Pyramid Lake, NV, the threatened Lahontan cutthroat trout (*Onchorhynchus clarki henshawi*, LCT) is the centerpiece of a world-class fishery. Maintained through stocking, LCT are no longer able to reach their natal spawning grounds due to damming and water diversions on the Truckee River. While past research on Pyramid Lake has focused primarily on water quality issues, the main focus of this study is to quantify the interactive and ecological effects of the aquatic food web and to identify potential limiting factors of LCT growth and survival. In addition to LCT, the fish community of Pyramid Lake is made up of two suckers, cui-ui (*Chasmistes cujus*) and Tahoe (*Catostomus tahoensis*), tui chub (*Gila bicolor*), the main forage item of LCT, and the invasive Sacramento perch (*Archoplites interruptus*). In this study we will survey the benthic invertebrate, vertebrate, and zooplankton communities of Pyramid Lake as well as physical and chemical parameters. Fish populations will be sampled using a variety of netting techniques and hydroacoustic surveys. Stable isotope analysis and food web modeling techniques will be used to demonstrate potential bottlenecks in the flow of energy throughout the food web. The three primary objectives of the study are to 1) identify factors limiting LCT growth and survival, 2) determine if exotic Sacramento perch are negatively impacting LCT through either exploitative or interference competition, and 3) quantify major pathways of energy through the food web.



Funding:

US Fish and Wildlife Service, Reno, NV.
USGS – Utah Cooperative Fish and Wildlife Unit (*in-kind*)

Investigators:

Phaedra Budy, Principle Investigator, USGS – UCFWRU, USU- Dept. of Watershed Sciences
Robert Al-Chokhachy, Research Fisheries Biologist, USGS
Gary P. Thiede, Fishery Biologist, USU- Dept. of Watershed Sciences
Nick Heredia, Graduate Research Assistant (M.S.) USU- Dept. of Watershed Sciences
{expected graduation, Fall 2013}

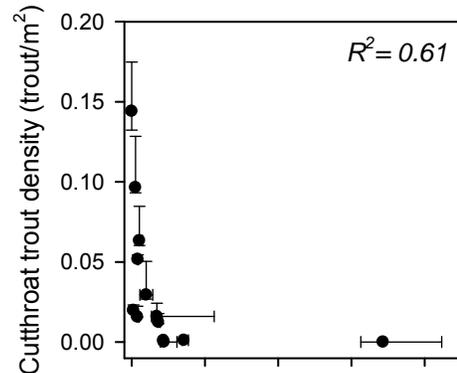
A Test of the Biotic Resistance Hypothesis with Native and Exotic Trout Assemblages In Stream Ecosystems: Towards a Better Understanding of Native Cutthroat Trout Restoration Options

Dates:

2009 – 2012

Abstract:

The Logan River, Utah, supports one of the largest remaining meta-populations of Bonneville cutthroat trout; however, as elsewhere, they are threatened by negative interactions with brown trout. Towards a broader goal of gaining a better understanding of native trout restoration options, we tested the hypothesis of biotic resistance in the Logan River using a large-scale, manipulative field study coupled with controlled laboratory and field experiments. Removal of brown trout conducted in 2009 - 2011 from tributary and mainstem habitat suggest that tributary habitat in the lower extent of the Logan River support high densities of exotic brown trout that demonstrate strong density dependence and likely serve as a source of brown trout to the mainstem Logan River, whereas populations in portions of the mainstem Logan River are likely supported by immigration from small impoundments in the lower river. Experiments testing for evidence of biotic resistance demonstrate that the outcome of competition between Bonneville cutthroat trout and brown trout is strongly influenced by the density of native trout. These results suggest that efforts to conserve high density populations or restore impaired populations are likely to increase resistance by native cutthroat trout to the establishment of invasive brown trout, and that mechanical removal of brown trout may be an effective alternative to eradication if native cutthroat trout can establish high density populations.



Salmo trutta

Funding and collaborators:

Utah Division of Wildlife Resources, US Geological Survey – CFWRU (*in-kind*), Trout Unlimited, Cache Anglers Chapter, US Forest Service, numerous other partners!

Investigators:

Phaedra Budy, Principle Investigator, USGS – UTCFWRU, USU – Watershed Sciences
W. Carl Saunders, Post-doctoral Research Scientist, USU – Watershed Sciences
Gary P. Thiede, Fisheries Biologist, USU – Watershed Sciences
Reed Chaston, Wes Gordon, Konrad Hafen, Undergraduate Researchers, USU – Watershed Sciences

Publications:

Saunders, W.C., P. Budy, and G.P. Thiede. 2011. Evaluation of demographic change following two years of mechanical removal of exotic brown trout *Salmo trutta* in the Logan River, Utah. 2010 Annual Report to Utah Division of Wildlife Resources. Endangered Species Mitigation Fund, Project # 1111. UTCFWRU 2011(4):1-28.
Budy, P., G.P. Thiede, C. Meredith, and N. Burbank. 2010. Logan River whirling disease study: factors affecting trout population dynamics, abundance, and distribution in the Logan River, Utah. 2009 Annual Report to Utah Division of Wildlife Resources. Sport Fish Restoration, Grant number XIII. Project F-47-R. UTCFWRU 2010(2):1-55.

Investigating Predator Prey Interactions in Scofield Reservoir, UT.

Dates:

2011-2014

Abstract:

Aquatic food webs are controlled by complex spatial and temporal interactions within and among trophic levels. The strength of interactions within the community may determine processes that regulate populations in the food web. Scofield Reservoir currently contains Utah chub, and is stocked with three top predators (rainbow trout, Bonneville cutthroat trout, and tiger trout), with unknown potential for competition for food and/or space. In order to design a greater study examining predator prey dynamics and interspecific interactions, we performed a pilot study during summer 2011 to comprehensively survey the fish community and limnology of Scofield Reservoir. From this pilot work, we identified several hypotheses of predator-prey and interspecific interactions. We will use bioenergetics modeling as a tool to explicitly consider the mechanisms that operate to structure populations and food webs and thus quantify predatory control of forage. We will also implement a controlled experiment through selectively stocking trout in ponds to examine multi-species competitive interactions. The results of this study will assist managers in establishing a more biologically efficient stocking program, by better understanding the factors limiting top predator fish growth and performance.



Funding:

Utah Division of Wildlife Resources
US Geological Survey – Utah Cooperative Fish and Wildlife Unit (in-kind)

Investigators:

Phaedra Budy, Principal Investigator, US Geological Survey–UCFWRU, USU Dept. of Watershed Sciences
Gary P. Thiede, Fishery Biologist, USU Dept. of Watershed Sciences
Lisa Winters, Graduate Research Assistant (M.S.), USU Dept. of Watershed Sciences (expected graduation, Spring 2013)

An Experimental and Modeling Approach to Predator-Prey Dynamics: Identifying Limitations of Predator Performance in High Desert Impoundments.

Dates:

2010-2012

Abstract:

The lands of the Uintah and Ouray Reservation in northeastern Utah are home to a series of small, high desert impoundments. These waters have been stocked with a variety of fishes annually with little understanding of biotic or abiotic conditions that limit fish growth and performance. During summer 2010, we undertook a pilot study of seven small impoundments on the reservation, and completed comprehensive field monitoring of fisheries and limnological information, in order to design a greater study of predator-prey interactions. Results from this pilot study indicated several predator-prey interaction hypotheses which we tested during the 2011 field season. A controlled field experiment was implemented using lake divider curtains and forage fish additions to examine limitations of predator growth and performance. We are also developing a foraging model to investigate and quantify visual foraging efficiency of predators between stable and dynamic systems. This suite of work will improve our overall understanding of aquatic predator-prey interactions with the specific goal of assisting the Ute Tribe Fish and Wildlife Department in establishing an improved sampling protocol, a more cost and biologically efficient stocking program, and a better overall understanding of the waters on the Uintah and Ouray reservation.



Funding:

Ute Indian Tribe Fish and Wildlife Department, US Geological Survey – UCFWRU (in-kind), USU Ecology Center, USU Graduate Student Senate

Investigators:

Phaedra Budy, Principle Investigator, US Geological Survey – UCFWRU, USU- Dept. of Watershed Sciences

Gary P. Thiede, Fishery Biologist, USU- Dept. of Watershed Sciences

Stephen Klobucar, Graduate Research Assistant (M.S.) USGS – UCFWRU, USU- WATS {expected graduation, Fall 2012}

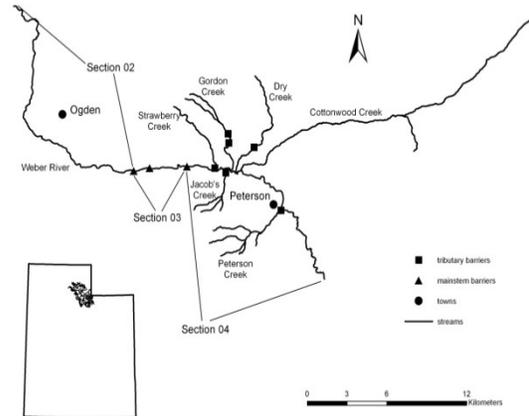
Weber River Metapopulation Structure and Source-Sink Dynamics of Native Fishes.

Dates:

2011-2013

Abstract:

The Weber River, Utah, is home to two sensitive fish species, Bonneville cutthroat trout (*Oncorhynchus clarkii utah*) and bluehead sucker (*Catostomus discobolus*). Puzzling strongholds of these species remain, despite potential impacts from habitat fragmentation, water management, and the presence of invasive species. Although populations of Bonneville cutthroat trout and bluehead sucker in the Weber River are especially important for management and conservation purposes, little is known about their specific life-histories and potential limiting factors in this system. We will test the hypothesis that a source-sink metapopulation dynamic exists between the tributaries and the mainstem populations of Bonneville cutthroat trout by using a combination of mark-recapture movement analysis, isotopic chemical markers in hard and soft tissue structures, and genetic relatedness. We will identify the locations and attributes of barriers to upstream movement in the tributaries and mainstem, and evaluate priority areas for barrier removal. A barrier in the mainstem at the canyon mouth has recently been retrofitted with a fish ladder, and we will test the effectiveness of this structure in passing Bonneville cutthroat trout and bluehead sucker through the use of a gated picket weir. We will also evaluate the population size and structure of Bonneville cutthroat trout in the mainstem Weber River and tributaries, and the bluehead sucker population size and structure in the mainstem. The main goal of this research is to identify limiting factors to these populations to allow managers to prioritize conservation actions.



Oncorhynchus clarkii utah

Funding and collaborators:

Utah Division of Wildlife Resources
Trout Unlimited
US Geological Survey – UCFWRU (in-kind)

Investigators:

Phaedra Budy, Principle Investigator, USGS – UCFWRU, USU – Watershed Sciences
Gary P. Thiede, Fisheries Biologist, USU – Watershed Sciences
Samuel McKay, Graduate Research Assistant, USU-Watershed Sciences /native aquatic biologist, UDWR

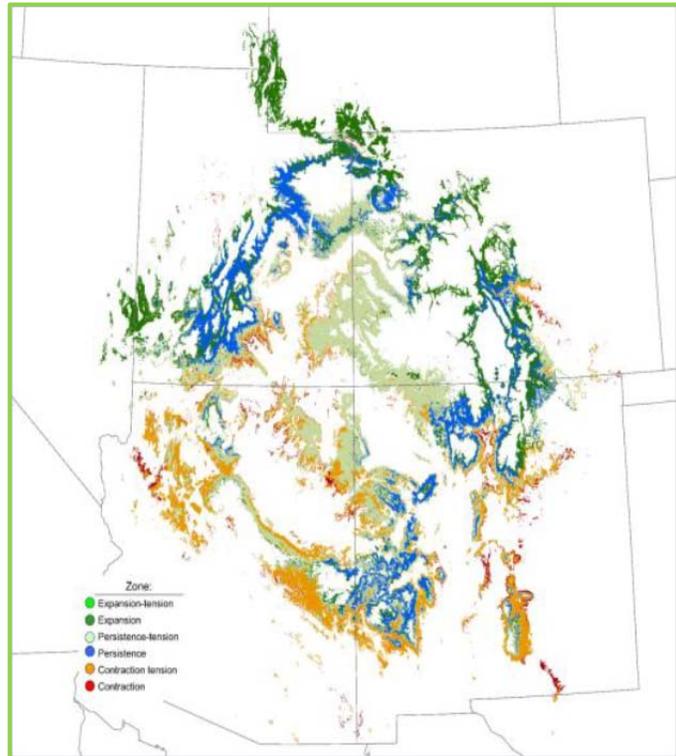
Modelling Climate Change Effects on North American Dry Mid-Latitude Conifers

Dates:

2009-2012 (Ongoing)

Abstract:

We are evaluating projected climate change effects on ~30 conifer species occupying the mid-dry latitudes of Western North America. The project involves three interrelated components. First, widely used climate projections (e.g., NCAR PM1) will be downscaled to 1km resolution for Western North America. Ensemble classifiers will next be used to model species distributions as functions of the downscaled climate variables to establish the relationships to current climate conditions. These models will then be linked with projected climate shifts and the potential shifts in species distributions evaluated. The third component focuses on defining the leading and trailing edges of the species distributions given projected climate changes.



Modeled expansion (dark, light green), persistence (blue grey), and contraction (red, orange) of the piñon pine as a result of projected climate change over the next 80 years.

Funding:

USDA Forest Service, Rocky Mountain Research Station, FIA Program

Investigators:

Thomas C. Edwards, U.S. Geological Survey UTCFWRU and Utah State University (PI)
Gretchen G. Moisen, USDA Forest Service Rocky Mountain Research Station
Niklaus Zimmermann, Swiss Federal Research Lab WSL
Jacob Gibson, Graduate Research Assistant (MS Ecology 2011)

Reports:

Gibson, J.R. 2011. Individualistic responses of piñon and juniper distributions to projected climate change. Unpublished M.S. Thesis, Utah State University.

Publications:

Gibson, J.R., G. G. Moisen, T.S. Frescino, N.K. Zimmermann, and T. C. Edwards, Jr. Effects of location "fuzz-swap" on species distribution models under projected climate change scenarios: how useful are projection models based on public data? In review, *Forest Ecology and Management*.

Gibson, J.R., G. G. Moisen, T.S. Frescino, N.K. Zimmermann, and T. C. Edwards, Jr. Individualistic responses of piñon and juniper distributions to projected climate change. In review, *Diversity and Distributions*.

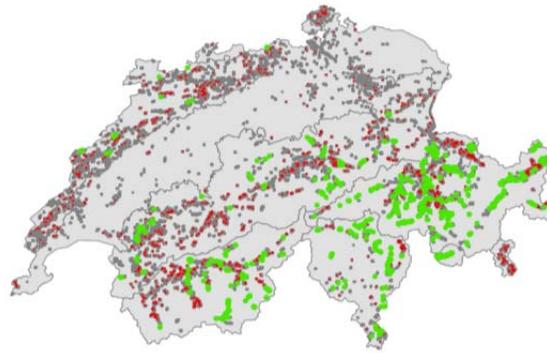
Challenges in Assessing and Forecasting Biodiversity and Ecosystem Changes in Europe

Dates:

2007-2012 (Completed)

Abstract:

We evaluated the synergistic effects of land-use and global climate change on plant and animal distributions in western Europe using satellite-derived land-use transition matrices, hindcasting for land-use history, and predictive forecasting of potential gains/losses in species areal extents due to economic and ecological forces. I work with the Swiss Federal Research Lab WSL research group, with responsibilities for development of spatially explicit models of land-use from socio-economic data, and distribution models of selected plant and animal species and groups. The project is a 5-year research effort on global change effects involving a consortium of 19 European Research Institutions from 11 nations.



Efficacy of economic mitigation at forestalling short-term (succession) and long-term (climate) ecological change impacts on Swiss high Alp meadows. Green=success; Red=failure; Grey=No change.

Funding:

European Union (funded through Swiss Federal Research Lab WSL, Birmensdorf, Switzerland)

Investigators (WSL associates only):

Niklaus Zimmermann and Felix Kienast, Swiss Federal Research Lab WSL
Thomas C. Edwards, U.S. Geological Survey UTCFWRU and Utah State University

Publications (5 of 7 listed):

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*.

Meier, E. S., T. C. Edwards Jr, F. Kienast, M. Dobbertin, and N. E. Zimmermann. 2011. Co-occurrence patterns of trees along macro-climatic gradients and their potential influence on the present and future distribution of *Fagus sylvatica* L. *Journal of Biogeography* 38:371-382.

Bolliger, J., T. C. Edwards, Jr., S. Eggenberg, S. Ismail, I. Seidl, and F. Kienast. 2011. Dry grassland meadows of high conservation priority: balancing forest regeneration probabilities and maintenance costs. *Conservation Biology* 25:567-576.

Zimmermann, N.E., T.C. Edwards, Jr., C.H. Graham, P.B. Pearman and J-C Svenning, Guest Editors. 2010. New trends in species distribution modelling. *Ecography* 33:985-1092. Special Issue: Species Distribution Modelling (10 Papers)

Albert, C. H., N. G. Yoccoz, T. C. Edwards, Jr., C. H. Graham, N. E. Zimmermann, and W. Thuiller. 2010. Sampling in ecology and evolution – bridging the gap between theory and

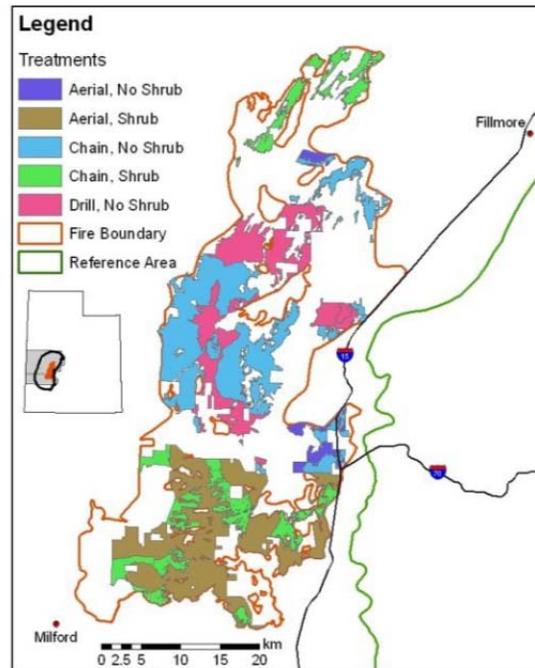
Avian Response to Post Wildland Fire Reseeding Treatments in The Great Basin Shrubsteppe

Dates:

2009-2011 (Ongoing)

Abstract:

The Milford Flat Fire was the largest wildfire recorded in Utah; considered catastrophic, concern exists that it would lead to a state change. To mitigate this state change, vegetation reseedling treatments were applied immediately post-fire. These treatments were two seed mix types, with or without a shrub component, and three mechanical applications, drill seeding, aerial seeding followed by chaining, and aerial seeding only. We are surveying the avian community in the different treatment types and in untreated areas within the fire. As there is no pre-fire data, we are sampling nearby areas of similar pre-fire habitat as reference. We are also collecting vegetation cover and structure data as covariates. These covariates will be used to identify any treatment effects.



Spatial locations of seeding treatments applied post-fire, Milford Flats, Utah

Funding:

Utah Division of Wildlife Resources

Investigators:

Thomas C. Edwards, U.S. Geological Survey UTCFWRU and Utah State University (PI)
Adam Brewerton, Graduate Research Assistant (MS Ecology)

Reports:

Brewerton, A. Avian response to post wildland fire reseedling treatments in Great Basin shrubsteppe. Unpublished M.S. Thesis, Utah State University, Logan, Utah.

Publications:

None; research ongoing

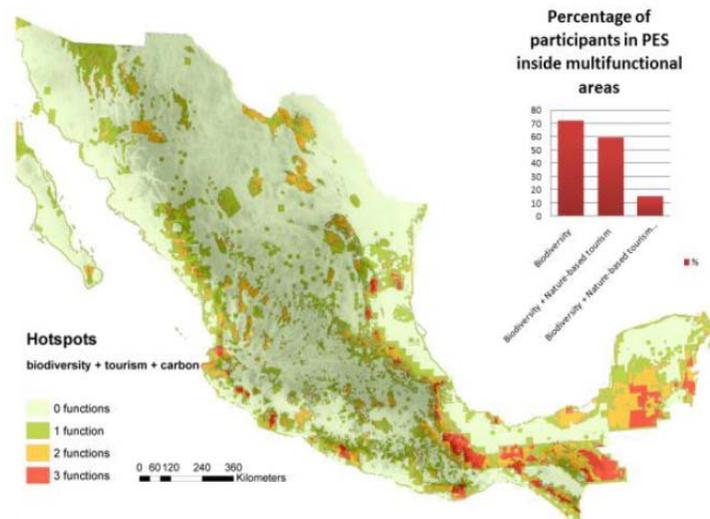
Sustainable Communities and Landscape Designs

Dates:

2010-2012 (Ongoing)

Abstract:

Environmental sustainability is important to the well-being of people and communities. Land cover and land use are known to affect the quality of a wide range of ecosystem processes and services. The distribution and pattern of land-use activities within a landscape or watershed can dramatically affect the quality of ecosystem services and well-being of societies. However, few studies have documented how community and city designs might affect the sustainability of ecosystem services. Most applications of ecosystem services in community and city planning have either been entirely conceptual, or are very early on in the process. However, rapid environmental change (e.g., climate change) requires a more immediate understanding of the ability of landscape designs to support and sustain a range of ecosystem. This project will develop a set of landscape metrics and models to capture differences in landscape designs and will compare those indicator and model results to conditions of ecological attributes and ecosystem services. An outcome of the project will be new methodologies to evaluate sustainability of ecosystem services.



Large-scale depiction of the capacity of Mexico lands to deliver specific ecosystem services. Three three functions evaluated here include gross biodiversity, nature tourism, and carbon sequestration.

Funding:

U.S. Geological Survey

Investigators:

Thomas C. Edwards, U.S. Geological Survey UTCFWRU and Utah State University (PI)
Bruce Jones, U.S. Geological Survey (Co-PI)
Felix Kienast, Swiss Federal Research Lab WSL (Co-PI)
Lorena Segura Morán, Universidad Nacional Autónoma de México, Mexico

Reports:

None; research ongoing

Publications:

None; research ongoing

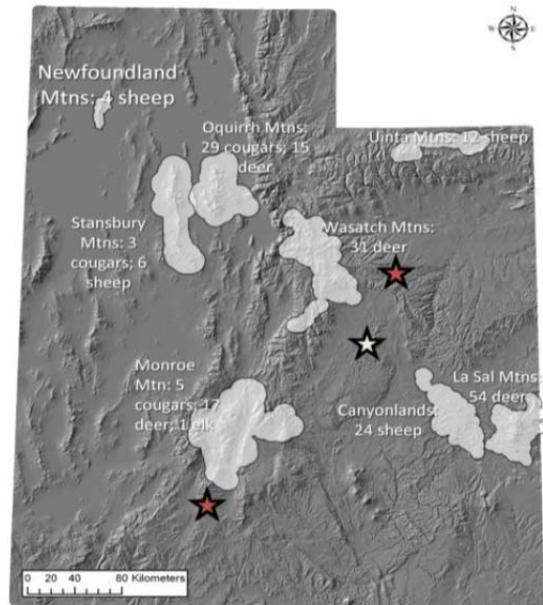
Spatial Responses to Climate Across Trophic Levels: Monitoring and Modeling Plants, Prey, and Predators in the Intermountain Western United States

Dates:

2011-2015 (New)

Abstract:

We will investigate the impact of climate on trophic linkages between primary productivity, herbivores, and top predators across landscapes in the Intermountain western United States. We will deploy GPS collars on 30 mule deer and use the data collected to model spatial patterns of ungulate density on a 16-day interval based on remotely sensed vegetation phenology. The resulting dynamic ungulate habitat models will be used to extrapolate predictions of prey density across the study area, which we will then use as the main predictor for modeling cougar movement using a decade of records collected from 70 intensely monitored individuals across the region. Resulting occupancy surfaces will be modified by spatially-explicit estimates of survival from known fates of >200 cougars to derive analogs of density. With the cost and occupancy surfaces from this analysis, we will then analyze the habitat and movement of cougars as a network to assess the sustainability of the regional cougar metapopulation.



Eight Utah sites from which ungulate and cougar data were collected, 2002-current. Stars indicate sites where elk (red) and bighorn sheep (white) are currently collared (data will be available spring, 2014).

Funding:

National Aeronautics and Space Administration

Investigators:

Joe Sexton, University of Maryland (PI)
David Mattson, U.S. Geological Survey and Northern Arizona University (Co-PI)
Thomas C. Edwards, U.S. Geological Survey UTCFWRU and Utah State University (Co-PI)
David Stoner, Post-doctoral Research Associate, Utah State University

Reports:

None: new research start

Publications:

None; new research start

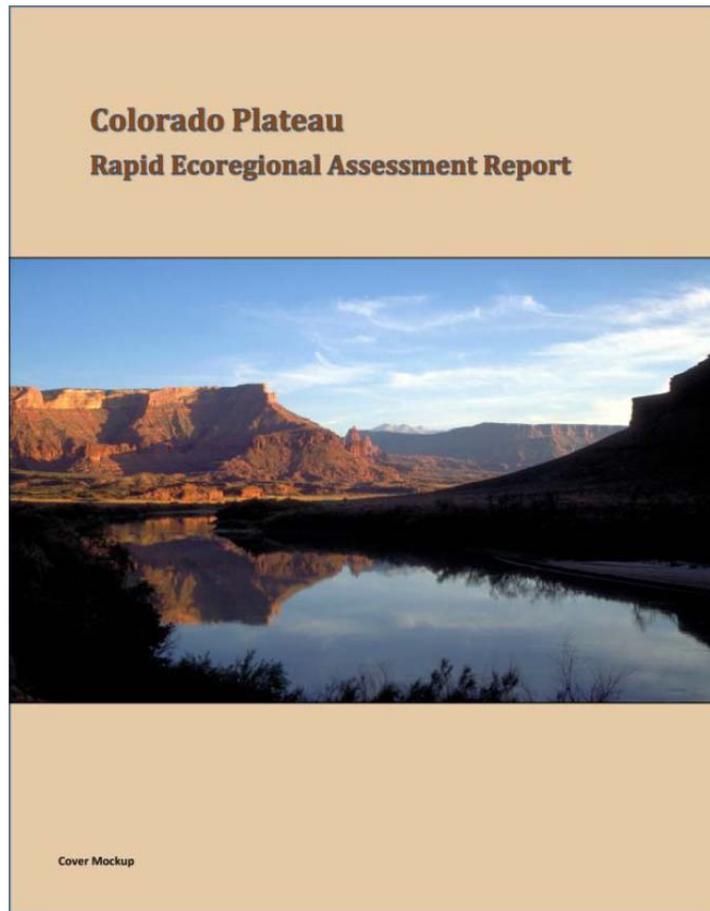
Colorado Plateau BLM Rapid Ecoregional Assessment

Dates:

2010-2012 (Ongoing)

Abstract:

Rapid Ecological Assessments (REAs) are a product of the Bureau of Land Management's evolution toward a landscape approach to land and resource management. Using the landscape approach, the BLM hopes to integrate available scientific data and information from BLM field offices, other federal and state agencies, and public stakeholders to develop shared responses and collaborative management efforts across administrative boundaries. Another objective of the REAs is to assess the current status of selected ecological resources (conservation elements) at the ecoregional scale and to investigate how this status may change in the future across several time horizons. REA results are expected to identify areas with high ecological integrity and high biological and ecological value—conservation areas, biological hotspots, and wildlife corridors—to provide a better understanding of key ecosystem processes and the potential impacts of future changes. REAs are timely in supporting planning, management, and mitigation strategies for impacts anticipated from various climate change scenarios as well as rapidly developing issues related to renewable energy development, the spread of invasive species, and changing fire regimes.

**Funding:**

Bureau of Land Management

Investigators:

Kate Kitchell, U.S. Geological Survey, Southwest Biological Science Center (Co-PI)
Thomas C. Edwards, U.S. Geological Survey UTCFWRU and Utah State University (Co-PI)
Other USGS Interdisciplinary Team Members

Reports:

In progress

Publications:

None expected