

Division of Agricultural Sciences and Natural Resources

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The Importance of Oklahoma Wetlands to Migrant Shorebirds

By: Craig Davis Professor and Bollenbach Chair



Wetlands in Oklahoma provide critical habitat for migrant shorebirds such as long-billed dowitchers.

Millions of shorebirds annually migrate through interior North America between their Arctic breeding grounds and temperate and tropic wintering grounds in Central and South America. During their migration, they rely on stopover sites, which are mostly wetlands, to refuel depleted energy and nutrient reserves that are critical for continuing migration, survival, and reproduction. You can think of these stopover sites as little gas stations located from Texas to Alaska. Another way to think of them is as stepping stones that shorebirds jump to and from during migration.

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As you can imagine, migrating through the Great Plains can be challenging, especially when you are looking for wetlands. Wetlands are spatially and temporally dynamic systems. One year they may have water and the next year they may be dry. Additionally, because this region is one of the most agriculturally intensive landscapes, most of the wetlands in the Southern Great Plains have been drained, degraded and modified. Furthermore, few of the remaining wetlands have protections. Finally, future climate change projections suggest possibly more intense storms, severe droughts, and hotter temperatures for some regions of the Great Plains. This may further alter wetlands in the Great Plains.

Given that shorebirds are scale-driven species, meaning that the relationship between shorebirds and habitat exists within a hierarchical system, shorebirds likely begin with broad-scale cues and progress toward fine-scale characteristics within landscapes to select which areas to use during migration. Shorebird habitat selection is confounded also by weather patterns that constrain distribution of habitat on the landscape. Recent research conducted by one of my Ph.D. students, Gene Albanese, attempted to determine how shorebirds select wetland stopover sites when migrating through a 10 county region in central Oklahoma. From a conservation perspective, it is critical that we understand how shorebirds select habitat so we can better manage wetlands and prioritize where to focus wetland restoration efforts through conservation programs such as the Wetlands Easement Program administered by the Natural Resource Conservation Service.

Our study was conducted from 2007 to 2009 during two very extreme weather patterns: a period of extreme drought and a period of above normal precipitation. Our results showed that shorebirds respond to these extreme weather events by shifting their use of stopover sites. During dry periods, when temperatures and evaporative losses increase and temporary wetlands disappear, shorebirds rely on more permanent water bodies that have expansive amounts of mudflat and shallow water (two important habitat components for shorebirds). In contrast, during wet periods when more permanent water bodies are completely inundated, shorebirds rely on temporary floodwaters that are abundant throughout the landscape. We examined shorebird occupancy patterns of wetlands throughout the region and found that shorebird occupancy was best explained by habitat density estimates at the 1 mile scale which indicates that it is at this scale that migrating shorebirds interact with the landscape when deciding which stopover sites to use during migration. Further, we found that migratory shorebird abundance and species richness increased with the amount of wetlands on the landscape. These results further indicate that shorebirds indeed are initially selecting habitat at a broad scale. By selecting landscapes with greater amounts of wetlands, migrating shorebirds are more likely to minimize energetic costs associated with locating resources because more habitat available within shorter distances results in improved energetic intake. Our results emphasize that conservation priorities should be given to large wetland clusters that include a mixture of more permanent waterbodies as well as temporary and ephemeral wetlands. As more and more wetlands become isolated, maintaining clusters of wetlands are becoming more critical for migrating shorebirds. Results from our research will better guide conservation strategies for migrating shorebirds in the Great Plains.



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Grazing: A Balancing Act for Quail Habitat

By: Laura Goodman, Assistant Professor and Range Extension Specialist

Northern bobwhite use a variety of vegetation types within their home range to fulfill requirements for survival. Grazing can improve quail habitat, but as with anything else, it requires moderation. Quail nesting begins in April and often occurs in warm-season grasses like little and broomsedge bluestem. Greater than 6 to 8 inch-tall vegetation is typically selected for. Since warm-season grasses are dormant in early spring, this height needs to be maintained through the winter from the previous growing season and can only be sustained with light or moderate livestock use. In addition, quail consume seeds and fruits produced during the previous growing season almost exclusively during the winter when insects are not available. Under heavy, continuous grazing, soil seedbank densities of grass seeds, as well as cattle-preferred forbs, decrease. Alternatively, if grazing is eliminated completely, seed discovery and accessibility can be hampered by thick layers of residual litter.

Plant species diversity, which is important for quail survival, is also influenced by grazing intensity. Plant species diversity can increase with grazing, as more bare soil, water, and light are available to forbs, compared to no grazing, where perennial grasses tend to dominate. Conversely, heavy long-term grazing usually decreases plant species diversity in the tall and mixed grass prairie. There are also indirect effects of heavy grazing as reducing plant species diversity can cause declines in insect numbers and variety, key components of the diet of bobwhite chicks and critically important for their survival.

Bobwhite chicks and hens require open passage ways at ground level and dense overhead vegetation, like forbs and low-growing shrubs. This allows them to navigate through the plants and find seeds and insects while being protected from aerial predators. Moderate stocking rates maintain the density of overhead vegetation while still allowing opportunistic forb species to become established and maintained.

Livestock grazing can be used to manipulate plant community composition and structure, such as tall forbs and low growing shrubs, to benefit northern bobwhite. The use of light to moderate stocking rates can create the different cover and food needs they require throughout the year.



The Nocturnal Habits of Lesser Prairie-Chickens

By: Ashley Tanner, Ph.D. Student

Nocturnal roosting habitat for lesser prairie-chickens was first described in the 1960's in Oklahoma. The work of Farrell Copelin and Robert Jones reported that moderately grazed pastures were preferred to heavily grazed pastures, and described the vegetation at roost sites as short relative to surrounding vegetation unless snow cover was present. These descriptions of lesser prairie-chicken nocturnal roosting habitat were all that existed for nearly 30 years. Since 1993, 2 additional studies have examined the characteristics of nocturnal roost sites, however nocturnal roosting was not the primary focus of the research.

Despite the fact that lesser prairie-chickens spend nearly half their time budget every day, throughout the year, at nocturnal roosting sites, we know relatively little about this behavior and associated habitat. At night, lesser prairie-chickens are under significantly different pressures than during the day. For example, some potential predators are more active at night, such as coyotes, bobcats, great-horned owls, and American badgers. These additional pressures may alter habitat selection from what is typically used during the day. The nocturnal roost locations of other species of grouse, such as the capercaillie and greater sage-grouse, are strongly associated with predator avoidance and availability of escape flight paths.

In an effort to learn more about nocturnal roosting behavior and habitat, we analyzed 31,324 nocturnal roost locations from 103 (71 males and 32 females) individual lesser prairie-chickens in Beaver County, Oklahoma. We found that mortality was no more likely at night than during the day. Once a lesser prairie-chicken selected a roosting site, movement from that site was rare. We found that lesser prairie-chickens moved at least 50m only about 6% of the nights, and moved more than 50m less than 3% of nights. Given the low rates of nocturnal movement, any disturbance that causes a chicken to move nocturnally would be especially disruptive to these birds. Additionally, we found that course scale habitat use during the night was not significantly different than habitat used during the day. Lesser prairie-chickens use areas with higher amounts of plant biomass for roosting.

Our results will help fill a substantial void in knowledge about lesser prairie-chicken ecology. These data can help managers make more well-rounded management decisions by providing information about what lesser prairie-chickens require during the day and the night.

Donor support of research and outreach programs is welcomed. We are always eager to hear from land owners, land managers, and donors regarding research ideas, concerns, and management questions.

To make a donation to the Wildlife Chairs at OSU:

- go to http://secure.osugiving.com, click "search here"
- type "wildlife chairs" in the search box
- when the results appear, choose either "Bollenbach Chair for Wildlife Management" or "Wildlife Conservation Chair" (Groendyke).





Influence of Management-driven Disturbance on Northern Bobwhite Space Use and Movement

By: Matt Carroll, Postdoctoral Fellow

Northern bobwhite inhabit fire-adapted grasslands and shrublands across much of their continental distribution, yet how bobwhites respond to disturbance (e.g., fire) is poorly understood. This knowledge gap is especially apparent in the western distribution of bobwhite (i.e., Oklahoma and Texas) where uncertainty still exists over the usefulness and proper application of prescribed fire. This vagueness serves as a barrier to optimizing management of bobwhite habitat. At the Packsaddle Wildlife Management (WMA) in western Oklahoma, we assessed bobwhite behavioral responses following dormant season burning (Jan-Mar; 2013-2014) by monitoring radio-marked northern bobwhites across burn treatments (0-12, >12-24, >24-36, >36 months post fire). We found that prescribed fire had a mostly neutral effect on bobwhite home range during the covey period with the exception that >24-36 months post fire treatments were associated with smaller covey home ranges (108.5 acres) than the most recent (0-12 months) (230.8 acres) or least recent (>36 months) (196 acres) burn treatments. Previous studies suggest that smaller home ranges may indicate greater habitat quality, as well as lower energetic costs and risk of encountering predators associated with movement for numerous species.

Spring dispersal movements were not correlated with time since fire, age, or sex of individuals (n=114), further demonstrating a mostly neutral effect of prescribed fire applied at relatively large spatial scales. Importantly, even in the case of the most recent burns (0 - <12 months post fire), mass departures of birds from the treatment areas or differences in dispersal movements were not observed. These findings suggest that land managers in sand shinnery oak vegetation communities can use prescribed fire across large spatial extents to optimize management impact without substantially altering the space use or movement of bobwhites. Analysis of how prescribed fire impacts other bobwhite life stages (e.g., nesting) is ongoing.

Post Doc and Grad Student Updates

Rachel Beyke, M.S., is in the process of publishing her research on thermal ecology and behavior of nesting quail.

Presentations:

 Beyke, R.L. 2016. Thermal Constraints on Reproductive Processes for Two Sympatric Ground-nesting Galliforms in the Southern Great Plains. 69th Annual Society for Range Management Meeting, Corpus Christi, TX.

Matt Carroll, Postdoctoral Fellow, is researching thermal ecology of northern bobwhite across multiple life stages. *Presentations:*

- Carroll, J.M., C.A. Davis, R.D. Elmore, and S.D. Fuhlendorf. 2016. Northern bobwhite response to thermal heterogeneity: Implications for ground-dwelling birds in rangelands. 69th Annual Society for Range Management Meeting. Corpus Christi, TX.
- Carroll, J.M., C.A. Davis, R.D. Elmore, and S.D. Fuhlendorf. 2016. Thermal constraints on northern bobwhite site selection during two key life stages. Oklahoma Natural Resources Conference. Oklahoma City, OK.
- Carroll, J.M., C.A. Davis, R.D. Elmore, and S.D. Fuhlendorf. 2016. Connecting Environmental and Management Factors with Northern Bobwhite Ecology. Coordinating Committee Meeting of the Oklahoma Cooperative Fish and Wildlife Research Unit. Stillwater, OK.

Cameron Duquette, M.S., is in the process of publishing his research on the impacts of fragmentation on northern bobwhite and vegetation and arthropod communities.

Presentations:

- Duquette, C.A., C.A. Davis, S.D. Fuhlendorf, R.D. Elmore, 2016. Indirect Effects of Well Pads, on Arthropods, Vegetation, and Soil Temperature Characteristics. 69th Annual Society for Range Management Meeting. Corpus Christi, TX.
- Duquette, C. 2016. Habitat Selection of Northern Bobwhite in an Energy Producing Landscape. Society for Range Management Annual Meeting,

Julia E. Earl, Postdoctoral Fellow, is working on the effects of climate change on long distance animal movements.

Presentations:

- Earl, J.E., L.R. Pauley, and R.D. Semlitsch. 2016. Frogs as Fertilizer? Effects of Metamorph Amphibians on Plant Growth. Oral Presentation at the Joint Meeting of Ichthyology and Herpetology in New Orleans, LA.
- Earl, J.E. and R.D. Semlitsch. 2016. High variability in metamorph leg length and relationships to resource level. Poster Presentation at the Joint Meeting of Ichthyology and Herpetology in New Orleans, LA.

Shelby Fraser, M.S., is in the process of publishing her research on coyote ecology in relation to anthropogenic and natural disturbances.



Sarah Gallaway, M.S. student, is evaluating rapid assessment methods in depressional and lacustrine wetlands in Oklahoma. Her field work has been completed and she is in the process of writing her thesis. Presentations:

• Gallaway, S.E. 2016. "Validation of the Oklahoma Rapid Assessment Method (OKRAM) in Depressional and Lacustrine Fringe Wetlands. Oklahoma Wetland Technical Work Group Meeting in Oklahoma City, OK.

Kate Golden, Ph.D. student, is evaluating the effects of fire on wetland plant communities and whooping cranes. She has completed two field seasons and is preparing to analyze data.

- Presentations:
- Golden K.E., C.A. Davis, and S.D. Fuhlendorf. Management implications for reducing a dominant native plant species. Oklahoma Natural Resources Conference. 2016. Tulsa, OK.
- Golden K.E., B. Hemingway, A. Frazier, C.A. Davis, and S.D. Fuhlendorf. Using historic survey data to determine whooping crane habitat use patterns at Aransas National Wildlife Refuge. 2016. 101st Ecological Society of America Annual Meeting, Fort Lauderdale, FL.

Dave Londe, M.S. student, is researching the response of grassland obligate birds to rangeland management practices and energy development. This is his second field season.

Allie Rakowski, M.S. student, is studying thermal ecology and effects of land use on wild turkey. This is her second field season.

Rheinhardt Scholtz, Postdoctoral Fellow, is researching the dynamics of woody encroachment in the Great Plains. He is currently analyzing data and writing manuscripts.

Presentations:

Scholtz, R., S.D. Fuhlendorf, S.A. Leis, and J. Picotte. 2016. Spatiotemporal patterns of fire behavior in the Great Plains, USA. Seminars in Ecology and Evolutionary Biology, Kansas State University, Manhattan, KS.

Heath Starns, Ph.D. student, is researching how patch-burning can enhance prairie-chicken habitat while managing rangeland fuels. He is currently analyzing data and writing his dissertation.

Presentations:

- Starns, H.D., R.D. Elmore, S.D. Fuhlendorf, T.J. Hovick, E.T. Thacker, and D. Twidwell. 2016. Patch-burning implications to fire behavior and prairie-chicken habitat. 2016 Patch-Burn-Grazing Conference. Childress, TX.
- Starns, H.D., R.D. Elmore, S.D. Fuhlendorf, T.J. Hovick, E.T. Thacker, and D. Twidwell. 2016. The effects of patch-burning on wildland fuels management. 69th Annual Meeting of the Society for Range Management. Corpus Christi, TX.
- Starns, H.D., R.D. Elmore, S.D. Fuhlendorf, T.J. Hovick, E.T. Thacker, and D. Twidwell. 2016. Patch-burning • supports heterogeneity of prairie-chicken habitat. 69th Annual Meeting of the Society for Range Management. Corpus Christi, TX.
- Starns, H.D., S.D. Fuhlendorf, R.D. Elmore, M.E. Morrow, and R.E. Chester. 2016. Attwater's prairie-chicken • use of burned areas. Poster. 69th Annual Meeting of the Society for Range Management. Corpus Christi, TX.

Ashley Tanner, Ph.D. student, is studying the effects of anthropogenic development on lesser prairie-chickens. She is currently analyzing data from the past three years of data collection and writing her dissertation. Presentations:

- Tanner, A.M., S.D. Fuhlendorf, R.D. Elmore, C.A. Davis, and M. Papes. 2016. Lesser prairie-chicken nocturnal roost site selection. Oklahoma Natural Resources Conference, Oklahoma City, OK.
- Tanner, A.M., J.Z. Kachel, S.D. Fuhlendorf, and S.L. Winter. 2016. Where the sagebrush burns: growing season wildfire and Artemisia filifolia. 69th Annual Society for Range Management Meeting, Corpus Christi, TX.



Evan Tanner, Postdoctoral Fellow, is researching mediation of thermal extremes as a landscape function. *Presentations:*

- Tanner, E. P., R. D. Elmore, S. D. Fuhlendorf, and C.A. Davis. 2016. Ecological pinch points affect usable space and survival of a ground-nesting bird. Oklahoma Natural Resource Conference, Oklahoma City, OK.
- Tanner, E. P., R. D. Elmore, S. D. Fuhlendorf, and C.A. Davis. 2016. Ecological pinch points affect usable space and survival of a ground-nesting bird. 69th Annual Society for Range Management Meeting, Corpus Christi, TX.

Wildlife Chairs' 2016 Research & Extension

2016 Research Publications

- Becerra, T.A., D.M. Engle, S.D. Fuhlendorf, and R.D. Elmore. 2016. Preference for grassland heterogeneity: Implications for biodiversity in the Great Plains. Society and Natural Resources DOI: 10.1080/08941920.2016.1239293.
- Bowman, D.M.J.S., G.L.W. Perry, S.I. Higgins, C.N. Johnson, S.D. Fuhlendorf, and B.P. Murphey. Pyrodiversity is the coupling of biodiversity and fire regimes in food webs. Philisophical Transactions of the Royal Society 371:20150169.
- Bried, J.T., A.M. Siepielski, D. Dvorett, S.K. Jog, M.A. Patten, X. Feng, and C.A. Davis. 2016. Species residency status affects model selection and hypothesis testing in freshwater community ecology. Freshwater Biology 61:1568-1579.
- Bried, J.T., S.K. Jog, C.A. Davis, and A.R. Dzialowski. 2016. Rapid buffer assessment fails to predict and classify wetland floristic quality in Oklahoma. Wetlands 36:799-805.
- Carroll, M.J., C.A. Davis, S.D. Fuhlendorf, and R.D. Elmore. 2016. Landscape pattern is critical for the moderation of thermal extremes. Ecosphere 7(7):art e01403.
- Dahlgren, D.K, R.D. Elmore, R.D. Rodgers, and M.R. Bain. 2016. Grasslands of Western Kansas North of the Arkansas River. Pages 259-279 in Studies in D.A. Haukos and C.W. Boal, editors. Avian Biology: Ecology and Conservation of Lesser Prairie-Chickens. Cooper Ornithological Society, University of California Press, Los Angeles, CA.
- Dahlgren, D.K., M.R. Guttery, T.A. Messmer, D. Caudill, R.D. Elmore, R. Chi, and D.N. Koons. 2016. Evaluating vital rate contributions to greater sage-grouse population dynamics to inform conservation. Ecosphere 7(3):art e01249.
- Davis, C.A., R.T. Churchwell, S.D. Fuhlendorf, D.M. Engle, and T.J. Hovick. 2016. Effects of pyric herbivory on source-sink dynamics in grassland birds. Journal of Applied Ecology 53:1004-1012.
- Dvorett, D., C.A. Davis, and M. Papes. 2016. Mapping and hydrologic attribution of temporary wetlands using recurrent Landsat imagery. Wetlands 36:431-443.
- Earl, J.E. and S.D. Fuhlendorf. 2016. Relative importance of climate variables to population vital rates: A quantitative synthesis for the lesser prairie-chickens. PloS one 11 (9), e0163585.
- Earl, J.E., S.D. Fuhlendorf, D. Haukos, A.M. Tanner, R.D. Elmore, and S.A. Carleton. 2016. Characteristics of lesser prairie-chicken long-distance movements across their distribution. Ecosphere 7(8):art e01441.



- Elmore, R.D. and D.K Dahlgren. 2016. Public and Private Land Conservation Dichotomy. Pages 187-203 in Studies in D.A. Haukos and C.W. Boal, editors. Avian Biology: Ecology and conservation of lesser prairie-chickens. Cooper Ornithological Society, University of California Press, Los Angeles, CA.
- Fuhlendorf S.D., and J.R. Brown. 2016. Future directions for usable rangeland science: From plant communities to landscapes. Rangelands 38:75-78.
- Hagen, C. and R.D. Elmore. 2016. Synthesis, Conclusions, and a Path Forward. Pages 345-351 in Studies in D.A. Haukos and C.W. Boal, editors. Avian Biology: Ecology and Conservation of Lesser Prairie-Chickens. Cooper Ornithological Society, University of California Press, Los Angeles, CA.
- Hovick, T.J., B.W. Allred, D.A. McGranahan, M.W. Palmer, R.D. Elmore, and S.D. Fuhlendorf. 2016. Informing conservation by identifying range shift patterns across breeding habitats and migration strategies. Biodiversity and Conservation DOI: 10.1007/s10531-016-1053-6.
- Krueger, E.S., T.E. Ochsner, J.D. Carlson, D.M. Engle, D. Twidwell, and S.D. Fuhlendorf. 2016. Concurrent and antecedent soil moisture relate positively or negatively to probability of large wildfires depending on season. International Journal of Wildland Fire 25:657-668.
- Limb, R.F., S.D. Fuhlendorf, D.M. Engle, and R.F. Miller. 2016. Synthesis Paper: Assessment of research on rangeland fire as a management practice. Rangeland Ecology & Management 69:415-422.
- McGranahan, D.A., T.J. Hovick, R.D. Elmore, D.M. Engle, S.D. Fuhlendorf, S.L. Winter, J.R. Miller, and D.M. Debinski. 2016. Temporal variability in aboveground plant biomass decreases as spatial variability increases. Ecology 97:555-560.
- Orange, J.P., C.A. Davis, R.D. Elmore, E.P. Tanner, S.D. Fuhlendorf, and E.T. Thacker. 2016. Evaluating the efficacy of brood flush counts: A case study in two quail species. Western North American Naturalist 76:485-492.
- Orange, J.P., C.A. Davis, R.D. Elmore, and S.D. Fuhlendorf. 2016. Temporary communal brooding in northern bobwhite and scaled quail broods. Western North American Naturalist 76:122-127.
- Tanner, E.P., R.D. Elmore, C.A. Davis, S.D. Fuhlendorf, D.K. Dahlgren, E.T. Thacker, and J.P. Orange. 2016. Does the presence of oil and gas infrastructure potentially increase risk of harvest in northern bobwhite? Wildlife Biology 22:294-304.
- Tanner, E.P., R.D. Elmore, S.D. Fuhlendorf, C.A. Davis, D.K. Dahlgren, and J.P. Orange. 2016. Extreme climatic events constrain space use and survival of a ground-nesting bird. Global Change Biology DOI: 10.1111/gcb.13505.
- Thacker, E.T., R.L. Hamm, J. Hagen, C.A. Davis, and F. Guthery. 2016. Evaluation of the Surrogator® System to increase pheasant and quail abundance. Wildlife Society Bulletin 40:310-315.
- Twidwell, D., A.S. West, W.B. Hiatt, A.L. Ramirez, J.T. Winter, D.M. Engle, S.D. Fuhlendorf, and J.D. Carlson. 2016. Plant invasions or fire policy: Which has altered fire behavior more in tallgrass prairie? Ecosystems 19 (2), 356-368.
- West, A.L., C.B. Zou, E. Stebler, S.D. Fuhlendorf, and B. Allred. 2016. Pyric-herbivory and hydrological responses in tallgrass prairie. Rangeland Ecology & Management 69:20-27.



2016 Extension Publications

- Elmore, R.D. and D.B. Arnall. 2016. Dove field management. Oklahoma Cooperative Extension Service, NREM 9024.
- Dale, L.L., A. Gourley, and R.D. Elmore. 2016. Using camera surveys to estimate white-tailed deer populations. Oklahoma Cooperative Extension Service, NREM-9023.
- Beyke R. and R.D. Elmore. 2016. How weather variables affect gamebirds in the southern Great Plains. Oklahoma Cooperative Extension Service, NREM-9022.

2016 Extension Activities

- Plight of the platte river: cranes, water, and people. Oklahoma City Audubon Society. Presentation. Oklahoma City, OK.
- Whooping crane: Back from the brink of extinction. Grand Lake Audubon Society. Presentation. Grove, OK.
- Ecology and conservation of migrant shorebirds in the southern great plains. Tulsa Audubon Society. Presentation. Tulsa, OK.
- Range management for the lesser prairie-chicken. 2016. Workshop for the Western Association of Fish and Wildlife Agencies. Woodward, OK.
- Land management for wildlife. 2016. Field Day. Clayton, OK.
- Endangered species. 2016. Extension In-Service. Stillwater, OK.
- Deer management. 2016. Extension In-Service. Stillwater, OK.
- Quail management. 2016. Field Day. Kaw WMA, OK.
- Conservation leaders for tomorrow workshop. 2016. Tipton, KS
- Ecology and conservation of North American forest grouse: Past, present, and future. 2016. Symposium at Annual Meeting of The Wildlife Society. 2016. Raleigh, NC..
- Rangelands as thermal moderators. 2016. Symposium at Society for Range Management Annual Meeting. Corpus Christi, TX.
- Fire effects on wildlife. NRCS Dormant Season Fire Training Workshop. Stillwater, OK
- Woodland management for bird conservation. Presentation at Texas Parks and Wildlife Woodland Management. 2016. Palestine, TX.
- Quail research updates. Oklahoma Wildlife Management Association and Legislative Open House. Presentation. 2016. Oklahoma City, OK.
- Fire-wise. Oklahoma Garden Ambassadors. Presentation. 2016. Stillwater, OK.
- Filmed 6 segments for SUNUP, 2016.
- Filmed 1 segment for Oklahoma Gardening, 2016.
- Provided content for 10 Ag. Communication articles, 2016.
- Beaver ecology article for the DASNR Water Center, 2016
- Worked with Oklahoma Department of Transportation, OSU Department of Horticulture and Landscape Architecture, and OSU Department of Integrative Biology to establish 80 monarch research and education signs along Hwy 51 and I-35, 2016.



2016 Professional Meetings Attended

- Society for Range Management Annual Meeting, Corpus Christi, TX.
- Minnesota Chapter of The Wildlife Society Annual Meeting, Mankato, MN.
- Oklahoma Natural Resources Conference, Oklahoma City, OK.
- Patch Burn Grazing Meeting, Childress, TX.
- The Wildlife Society Meeting, Raleigh, NC.
- Ecological Society of America Meeting, Orlando, FL.

2016 Awards and Honors

- Craig Davis Outstanding Alumnus Award, Texas Tech University, Department of Natural Resources Management.
- Craig Davis, Dwayne Elmore and Sam Fuhlendorf Outstanding Peer-reviewed Scientific Article, (senior author of the paper was post-doc Matt Carroll), Oklahoma Chapter of The Wildlife Society.
- Dwayne Elmore Group Achievement Award, The Wildlife Society.
- Dwayne Elmore Outstanding Technical Publication, (senior author of the paper was former MS student Adam Gourley), Oklahoma Chapter of The Wildlife Society.

Oklahoma State University Wildlife Chairs

Craig Davis holds the Bollenbach Endowed Chair in Wildlife Management with both research and teaching responsibilities. He works on a variety of research projects including upland gamebirds, avian ecology and management, and wetland ecology and management. He can be contacted at craig.a.davis@okstate.edu or 405-744-6859.

Dwayne Elmore holds the Bollenbach Endowed Chair in Wildlife Management with a focus on extension and research. He works on a variety of projects including upland gamebirds, prescribed fire, and wildlife habitat management. He can be contacted at dwayne.elmore@ okstate.edu or 405-744-9636.

Sam Fuhlendorf is a Regents Professor and holds the Groendyke Endowed Chair in Wildlife Management. He has both research and teaching responsibilities and works on a variety of research projects including patch burn grazing, prescribed fire, and wildlife management. He can be contacted at sam.fuhlendorf@okstate.edu or 405-744-9646.