DEPARTMENT OF
Natural Resource
Ecology & Management

NREM Department Newsletter for 2016

Issue Date: January 20, 2017

Greetings from the NREM Department Head

It has been a whirlwind year as I came on board as NREM Department Head in mid-March, just in time for the 3 "B's" – **B**anner, **B**udget cuts and being **B**ounced around with earthquakes!!

Seriously, coming from a rangeland research background at Texas A&M's off-campus research and extension center in Vernon, I wanted to get back to a university town and experience a broader range of natural resource issues and other things a university campus offers. So, I am very excited to be part of the NREM department at OSU! I left a fun and rewarding research program in Texas, but I still get a chance to experience all the great research the NREM department and others at OSU are doing. My career research "mantra" has always been "sustainable agricultural production" and I think that fits in well with NREM and DASNR.

It has been rewarding to learn about the other parts of the land grant triangle – the academic/curriculum details and our extension activities. I also have enjoyed getting to know our faculty, post-docs, graduate students, undergrads, our wonderful support staff and the scientists and staff at the OKCFWRU "Coop" Unit. We do face challenges ahead with maintaining high teaching and advising standards under increasing enrollments and declining budgets. In addition, we have the continual challenge of increasing our research and extension visibility and impact among state, national and international stakeholders. But I knew it before I came here that we have a great, talented group of faculty and staff in NREM - and this feeling has only been reinforced since arriving. I have no doubt we will continue to excel and meet these challenges and fulfill our land grant mission.

Following is chronological account of some of the important events, awards and products that were a part of our NREM family in 2016. Thanks to all that have helped me along this first year!! ---Jim Ansley

February 2016

NREM Receives Several Awards at the Oklahoma Natural Resources Conference (OKNRC) in Oklahoma City

Faculty and students gave several presentations at the OKNRC meeting February 24-26, 2016 in Oklahoma City and several NREM students and stakeholders received awards:

Winner of the Oklahoma Chapter of The Wildlife Society **Outstanding Peer-reviewed Scientific Article** was J. Matthew Carroll, Craig A. Davis, R. Dwayne Elmore, Samuel D. Fuhlendorf, and Eric T. Thacker for their paper "Thermal Patterns Constrain Diurnal Behavior of a Ground-dwelling Bird" published in Ecosphere (2015).

Winner of the Oklahoma Chapter of The Wildlife Society **Outstanding Technical Publication** was Adam Gourley (former M.S. student), Dwayne Elmore, Mike Porter, Russell Stevens, John Weir, and Terry Bidwell for their paper, "A Practical Guide to Food Plots in the Southern Great Plains"

Two of our stakeholders received awards at the annual Oklahoma Natural Resource Conference held in Oklahoma City. **Mr. Win and Kay Ingersoll** received the **Oklahoma Private Land Management Award** given by the Oklahoma Chapter of The Wildlife Society. The Private Land Management Award recognizes exemplary contributions to natural resource management on private land. In addition to being major supporters of the Oklahoma State University and NREM department, the Ingersoll's manage a ranch in northeastern Oklahoma that is an outstanding example of managing private land for the benefit of a host of wildlife species. Currently, the Ingersolls support a quail research project under the direction of Dr. Scott Loss on their property. The Ingersolls were nominated for the award by Dr. Scott Loss.

Mr. John Groendyke received the **Harold C. Stuart Conservation Excellence Award**, also given by the Oklahoma Chapter of The Wildlife Society. The Harold C. Stuart Conservation Excellence Award is given to a lay person or group that has contributed significantly towards enhancing conservation stewardship and perpetuating a conservation ethic through activities in Oklahoma.

Mr. John Groendyke has been a leader in conservation of Oklahoma's unique landscapes and wildlife throughout much of his life. He is in his record sixth term as commissioner for the Oklahoma Department of Wildlife Conservation. He has served as a Trustee for The Nature Conservancy and has been a strong supporter of the NREM Department at OSU as evident by the establishment of an Endowed Chair in Wildlife Conservation in his name. Mr. Groendyke is an avid quail hunter and has served as past president and chairman of the Grand National Quail Foundation and the Grand National Quail Club. He has been a leader in conservation for Oklahoma wildlife and has been instrumental in making more land stay in its natural state and become accessible for hunting and outdoor recreation. Mr. Groendyke was nominated for the award by Sam Fuhlendorf. ---Jim Ansley

"On land ethic: A thing is right when it tends to preserve the integrity, stability and beauty of the biotic community. It is wrong when it tends otherwise."
— Aldo Leopold

February 2016

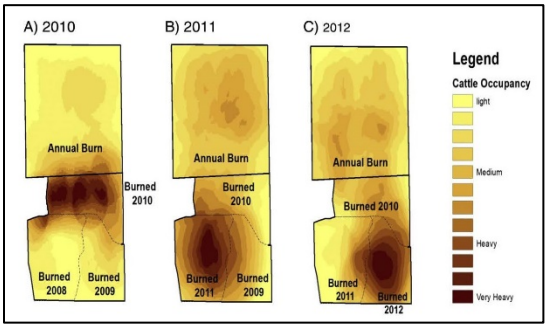
NREM Research Highlight: Patch Burning, Hydrology and Cattle Grazing

A study by graduate student Amanda West entitled, "Pyric-herbivory and Hydrological Responses in Tallgrass Prairie" was published in *Rangeland Ecology and Management* in 2016. Amanda's advisors were Drs. Chris Zou and Sam Fuhlendorf. Portions of the Abstract are reprinted here:


Rangeland Ecology & Management

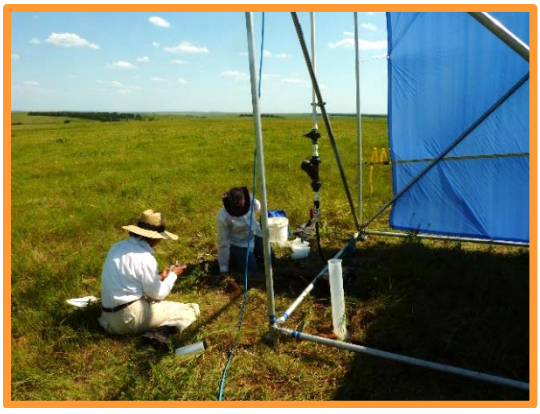
Pyric-herbivory and Hydrological Responses in Tallgrass Prairie

Pyric-herbivory is the spatial and temporal interaction of fire and grazing on area resources that results in site selection by animals on recently burned areas. Pyric-herbivory promotes heterogeneity by increasing bare ground on some patches and litter and aboveground biomass on other patches. The influences of this heterogeneity on hydrological properties and sediment transport are not well documented. We monitored the pattern of cattle occupancy on annually burned and patch burned pastures under moderate stocking rates of steers in the Tallgrass Prairie Preserve and quantified surface runoff and sediment transport for simulated rainfall of 10-year return storm intensity applied to different phases of the fire-grazing interaction in 2011 and 2012. Results showed that patch burn altered grazing distribution with cattle spending 70% of their time within the most recently burned areas.



A figure from the paper showing cattle distribution related to patch burning.

Our rainfall simulation results showed the high-intensity grazing following a spring fire did not have a prolonged, ecologically meaningful detrimental impact on hydrological properties of the burned patch in comparison with annually burned grazing pasture.



Amanda West and Senior Research Specialist Elaine Stebler collecting data at the site.

February 2016

OSU Range Club Wins Award at International Society for Range Management Meeting

The OSU NREM Range Club won first place in the Trade Center Display Board competition at the 2016 Society for Range Management Annual Meeting in Corpus Christi, TX. Club members included Duel Brown, Corban Hemphill, Tanner Large, Ethan Marshall, Jeremy Schallner, Hannah Stevens, Jack Tidwell, and Dee Vandaveer. They are advised by Dr. Karen Hickman. Their theme centered on 9 wildlife species from the member's home states of Oklahoma, Kansas and Texas. Club President Jack Tidwell said, "We selected this topic because we felt that describing wildlife species and their habitats was an appropriate way to address the meeting's theme of 'Rangelands and Wildlife.'" The Stillwater newspaper had this article:

Reader photos

Send your photos to the News Press by email at readers@stwnewspress.com

OSU Range Club earns national recognition among peers

By Sean Hubbard
OSU Communications

For the members of the Oklahoma State University Range Club it is about networking, but it is always nice to bring home a little hardware in the process.

Recently, at the 2016 Society for Range Management Annual Meeting, Technical Training and Trade Show in Corpus Christi, Texas, the OSU Range Club did both. Club members competed with university range programs from Mexico, Canada and the United States and won 1st place in the Display Board competition.

OSU Range Club President, Jack Tidwell, said the display board analyzed nine wildlife species from the members' home states of Oklahoma, Kansas and Texas.

"We selected this topic because we felt that describing wildlife species and their habitats was an appropriate way to address the meeting's theme of 'Rangelands and Wildlife,'" he said. "We also felt that showing the diversity of our members' backgrounds and the knowledge of different ecosystems that they bring with them to our club was important."

The annual meeting is typically circled on OSU Range Club members' calendars well in advance of the event.

"We put an intensive amount of work into our preparation for these competitions at the National SRM Meeting," said Tidwell. "Our first place display board took an effort by the entire team in regards to innovation, creation, organization and in presenting its information to achieve its top standing."

The eight-member team is made up of Tidwell, Marlow, Oklahoma; Hannah Stevens (treasurer), Ardmore, Oklahoma; Jeremy Schallner (vice president), Enid, Oklahoma; Corban Hemphill (secretary), Hondo, Texas; Tanner Large, Okmulgee, Oklahoma; Duel Brown, Dewey, Oklahoma; Ethan Marshall, Bixbi, Idaho; and Dee Vandaveer, Blanchard, Oklahoma.

Schallner placed 2nd in the Undergraduate Range Management Exam, and Hemphill and Schallner gave presentations on their undergraduate research.

"The OSU Range Club is continually ranking in the top three range clubs in the country," said Karen Hickman, club adviser and professor in OSU's Department of Natural Resource Ecology and Management. "The opportunities and networking the students participate in as Range Club members enhances their career placement potential."

SUBMITTED

OSU Range Club members from left to right: Hannah Stevens, Duel Brown, Ethan Marshall, Dee Vandaveer, Corban Hemphill, Tanner Large, Jack Tidwell and Jeremy Schallner recently attended the Society for Range Management Annual Meeting.

March 2016

Travel Abroad – Ecuador and Galapagos Islands

In March 2016 we offered our fifth study-trip to Ecuador and the Galapagos Islands. Our principal objectives for all of our study-trips are to explore unique ecosystems and cultural settings in places that are in stark contrast to our familiar day-to-day life here in Oklahoma and the USA, and to gain a more "global" perspective regarding the relationship between people, the land, and its resources…and in the process, provide an opportunity for our students to have life-changing experiences.

Ecuador continues to be an outstanding destination to serve this ambition. We split our time and experience there between the upper Amazon rainforest, the high Andes Mountains, and the Galápagos Islands 600 miles offshore, with all of our destinations just a "few chains" north or south of the equator. The ecosystems in these three locales are dramatically different and *amazingly dramatic!* In the Amazon, we stay at an eco-lodge and trek through the dense and richly green jungle to experience rainforest diversity and ecology. In jungle villages, we experience the successes of sustainable community development by interacting with villagers, farmers, and entrepreneurs, and pitching in with their work, getting our hands a little dirty. We learn about the cultivation of tropical fruits and vegetables, and then harvest some to prepare a delicious jungle lunch. We go through a purification ritual with a shaman, and learn how to chuck a spear and shoot a blowgun. If we all had to rely on these to acquire our food like the villagers do, we Okies would starve!

High in the Andes Mountains where it is quite cool, and downright cold at night, requiring woolens and a good parka, we fire up the hearth each night at our mountain lodge. We have fascinating programs with traditional weavers, hat-makers, and a family that makes pan pipes and other cool instruments that combine to produce that wonderful ethereal Andean music. We are invited into homes, gardens, and workplaces, and we engage in a captivating program with a traditional "yachak" or medicine man who spews a bit of fire…*real fire!* We experienced traditional "chagra" (Ecuadorian cowboy) lore and ride horses up through the potato, barley, quinoa, and bean fields, and beyond, up through the stunning, grassy, paramo ecosystem on the flanks of a volcano at 13,000 feet, wearing wool ponchos and alpaca chaps. Ultimately, there's snow way up there in the high country…*on the equator*…and that chagra garb feels great!

Finally, we fly westward from the mainland out across the Pacific Ocean to the Galápagos Islands, 600 miles off-shore and still on the equator. Here, the equatorial sun and cold Pacific waters combine to provide a very pleasant spring-like climate *most* of the time. Sometimes on the old lava fields, it gets quite hot! The Galápagos landscape is quite stunning, with dramatic volcanic features, pristine beaches, and many endemic plant and animal species. The wildlife are quite approachable, as historically there have been no large land-based mammalian predators at Galapagos sitting atop the food chain, evoking "fight or flight." So you can get right up close to a sea lion, iguana, or giant tortoise for a cool picture. The animals are still wild----they just don't seem to care that you are there! We are amazed at unique birds there including the blue-footed booby, magnificent frigate bird, hoatzin, several different hummingbirds, Darwin's finches and the Galapagos penguin…yep, penguins on the equator! We snorkel amidst sea lions, spotted leopard rays, sea turtles, and many fascinating fish. We climb to the summit of the largest volcanic caldera in the archipelago. We visit a tortoise rearing center. We scramble through some lava tubes. We dine on delicious fresh-caught tuna, right out of the Pacific. Wow…what a cool experience!
---Tom Kuzmic

March 2016

Jim Ansley Joins OSU as New NREM Department Head

Jim Ansley joins the Oklahoma State University family from an off-campus research and Extension center in the Texas A&M system to become the head of OSU's Department of Natural Resource Ecology and Management. After 32 years of range research in Texas, Ansley is excited to see what Oklahoma is all about.

Immediately following his Ph.D. in 1983 from the University of Wyoming, Ansley began his career in research with the Texas Agricultural Experiment Station. Four promotions later, and earning the title of Regents Professor from Texas A&M AgriLife Research, Ansley begins his tenure at OSU.

"Dr. Ansley's career has prepared him very well to take this important role in working with our most valuable resource, the students," said Tom Coon, vice president, Division of Agricultural Sciences and Natural Resources. "We are very fortunate to attract the best faculty to the natural resource ecology and management department and under the direction of Dr. Ansley, our students, and the cutting-edge programs directed by our faculty, will continue to excel."

Interaction with students was a major driving force in Ansley's decision to transplant his family to Stillwater. However, his wife Teresa and their two daughters, Beth and Caitlin, are eager to put down roots in Middle America.

"It was a difficult decision to leave but we were wanting to get closer to a university environment and get back to the excitement of being with students," he said. "I was very interested in the diversity of expertise within the NREM department. It seems like a great fit for the things I am most interested from a research, teaching and Extension standpoint."

"I was familiar with the excellent range research and Extension program here, but I have been delighted to find such tremendous expertise in the wildlife, forestry and fisheries areas as well," he said. "Plus, we have a growing ecohydrology group that is adding a new and important dimension to the department."

---Excerpt from article by Sean Hubbard, Communications Specialist, OSU Agricultural Communications Services

March 2016

Tom Kuzmic Wins Teaching Award at CASNR Awards Banquet

Dr. Tom Kuzmic was recognized as Teacher of the Year at the CASNR awards banquet on March 31, 2016. Photos are Tom Kuzmic with Dr. Tom Coon, Vice President and Dean DASNR, and Dr. Cynda Clary, Associate Dean CASNR. Well-deserved Tom!!

March 2016

Omkar Joshi Joins NREM as an Assistant Professor of Forestry Management and Economics

Dr. Omkar Joshi joined the NREM faculty in March, 2016 after working for several years with the Texas Forest Service (Texas A&M University System).

Dr. Joshi received his B.S. degree in forestry from Tribhuwan University in Nepal, his M.S. in Forest Policy and Economics from the University of Arkansas-Monticello, and his PhD in Forest Management and Economics from Mississippi State University.

Dr. Joshi was hired with a 60% research and 40% teaching appointment. His research interests are in (1) ecosystem services valuation of forest and other natural resources, (2) human dimensions and economics related issues in natural resources, (3) wood-based and other renewable energy issues, and (4) wildlife and energy economics.

Omkar will initially be teaching Timber Management (NREM 4323) and Forest Resource Management: Planning and Decision-Making (NREM 4333). This will later change to a new course NREM 4324 Forest Economics and management. He will also help direct one of the summer camps. If you have not yet had the chance, please welcome Omkar on board!

March 2016

NREM's Adam Cobb Takes First at 3MT

Adam Cobb, PhD student with Dr. Gail Wilson, won first place and $1,000 at the fourth Oklahoma State University Graduate College Three Minute Thesis (3MT®) competition for thesis master's and Ph.D. students on March 3 in the Student Union Theater. He had won first place in a preliminary CASNR round on February 11.

Adam Cobb presenting his 3MT at the Student Union

The contest challenges the speaker to effectively deliver their message without any props in 3 minutes. Adam's talk was titled "From Soil Ecology to Human Nutrition" and he discussed how improvement of soil microorganisms can increase food production worldwide. A complex topic to convey in 3 minutes. Nice job Adam!!

April 2016

50 Student Scholarships Presented at NREM Awards Banquet

Fifty student scholarships were awarded at the 10th annual NREM Awards Banquet on April 11, 2016. These scholarships are only possible through the sponsors of the awards and recipients are listed below:

UNDERGRADUATE STUDENT AWARDS AND SCHOLARSHIPS

Joseph Fleming Memorial Scholarships in NREM

The Fleming Scholarships are funded through a trust established by Joseph Fleming. Mr. Fleming directed his trust to support agriculture schools in the various states in which he acquired properties. Students majoring in NREM with a successful academic record are eligible to receive this scholarship. Award to: **LOGAN CHRISTENSEN**, Sophomore in Fire ecology and management from Crescent OK; **SHAUNA FOLCHERT**, Freshman in Wildlife Biology and Pre-Veterinary Science from Sioux City, Iowa; **KAYLEIGH LOCKE**, Freshman in Wildlife Ecology and Management from Enid, OK; **BRITTANY SIMONS**, Senior in Wildlife Ecology and Management from Mannford, OK; **ABIGAIL SMITH**, Junior in Fisheries and Aquatic Ecology from Oklahoma City, OK; and **ASHLEY B. STANBERRY**, Senior in Wildlife Ecology and Management from Stillwater, OK.

C. Lee Clymer Memorial Scholarship

Established by Ms. Mattie Clymer Lawless, this scholarship memorializes Lee Clymer who served as Extension Forester in Antlers, Okla., from 1950-1977. Lee was instrumental in establishing the Youth Forestry Camp which is held annually in southeast Oklahoma. The scholarship recognizes the top student who completed the Forestry Summer Field Camp the previous year. Award to: **ELIZABETH CORBISHLEY**, Senior in Forest Ecology and Management from Oklahoma City, OK.

Weyerhaeuser Company Scholarships

Established in 1972 by the Weyerhaeuser Foundation, two scholarships are awarded annually to qualified, full-time students in Forest Ecology and Management option in NREM. Award to: **JEFFREY HAWKINS**, Sophomore in Forest Ecology and Management from Wright City, OK; and **CLINT WARDLOW**, Senior in Forest Ecology and Management from Yukon, OK.

Lew Meibergen Honorary Scholarship in Range Land Management

The Lew Meibergen Honorary Scholarship is awarded annually to a full time undergraduate student at Oklahoma State University classified as junior or senior in NREM. Award to: **HANNAH STEVENS**, Senior in Rangeland Ecology and Management from Overbrook, OK.

Thomas C. & Marie Jones Endowed Scholarship

This scholarship was funded by Mr. Thomas Jones, alum of the fisheries program at OSU in the 1960's. The recipient must be a Junior or Senior in NREM, show leadership by participating in civic and/or campus organizations, and have demonstrated an interest in the non-profit sector. Award to: **TAYLOR MULLER**, Sophomore in Wildlife Biology Pre-Veterinary Science from Altus, OK.

Roque Nalley Memorial Scholarship

This scholarship was established in 2013 in memory off Roque Nalley. Roque received

his Bachelor's Degree in Forestry and Agriculture from Oklahoma State in 1977 before receiving his Master's degree from the University of Idaho in Forest Resources. The scholarship will be awarded to a student with a GPA of 3.25 or greater. First preference will be given to students in Forestry. This is the 1st year for this award. Award to: **RACHEL VAN FLEET**, Freshman in Forest Ecology and Management from Glennpool, OK.

A.A. & Mary Lue Sewell Award

The Sewell Award is presented annually to the outstanding upper-division Wildlife major for achievement and involvement in wildlife and career-related activities academics, and work, in that order. Luann Waters established this scholarship in honor of her parents. Award to: **KALYNN BRANHAM**, Sophomore in Wildlife Ecology and Management from Sallisaw, OK.

Oklahoma Rangeland Heritage Endowed Scholarship

This award recognizes the highest scoring individual in the range judging competition at the National Land and Range Judging Contest each year. This recipient must be an undergraduate in Natural Resources and Ecology and Management at Oklahoma State University. Award to: **ANDREW MAININI**, Junior in Rangeland Ecology and Management from Boerne, Texas.

Brown Forestry Summer Camp Scholarships

The Brown scholarships were established by the estate of Faye Allene Brown, wife of Floyd Brown, a member of the first graduating class in forestry at OSU and former staff member of the Department of Forestry. The award was created to assist students with Forestry Summer Camp expenses. Award to: **JAMES T. ALLEN**, Senior, Forest Ecology and Management from Oklahoma City, OK; **REBEKAH BANKS**, Senior in Forest Ecology and Management from Piedmont, OK; **JORIS BIDDICK**, Junior in Forest Ecology and Management from Norman, OK; **KELSEY DAHMS**, Sophomore in Forest Ecology and Management from Oklahoma City, OK; **JACOB HAMMONS**, Transfer student from Eastern Oklahoma State College; **JEFFREY HAWKINS**, Sophomore in Forest Ecology and Management from Wright City, OK; **STEPHEN HOLT**, Sophomore in Forest Ecology and Management from Claremore, OK; **DEIDRA RITCHHART**, Junior in Forest Ecology and Management and from Jasper, Missouri; and **NATHAN WADE**, Junior in Forest Ecology and Management and from Perry, OK.

Foutch Summer Camp Scholarship

This scholarship was established by Carolyn Jacob Foutch of Council Bluffs, Iowa, to assist students with Summer Field Camp expenses. Ms. Foutch is an alumna and ardent supporter of OSU. Award to: **BURT SCHMELZENBACH**, Sophomore in Forest Ecology and Management from Cape Town, South Africa; and **JOSEPH RULE**, Junior in Forest Ecology and Management from Tulsa, OK.

Brown - Erwin Transfer Scholarship

This scholarship was established by the estates of Floyd Brown and Roger Erwin, OSU Forestry alums, who recognized the importance of recruiting high quality students into the area of forestry. Award to: **RACHEL VAN FLEET**, Freshman in Forest Ecology and Management from Glennpool, OK; and **STEPHEN HOLT**, Sophomore in Forest Ecology and Management from Claremore, OK.

Ted Silker Memorial Award
Established by Mrs. Cleo Silker and friends, this scholarship memorializes Dr. Ted Silker, a member of the Forestry faculty from 1961-1979. Dr. Silker was particularly interested in motivating students through the Summer Field Camp and in field work. The award is presented annually to the student who attended the previous year's summer camp and who has demonstrated great improvement in forestry skills because of the camp experience. Award to: **JOSEPH G. RULE**, Junior in Forest Ecology and Management from Tulsa, OK.

Oklahoma Section of the Society of Range Management Scholarship
The Oklahoma Section of the Society for Range Management scholarship recognizes a Rangeland Ecology & Management student for their academic success and active participation in the OSU Range Club. Award to: **NOLAN CRAUN**, Senior in Rangeland Ecology and Management from Bartlesville, OK; and **JOHN MCQUAIG**, Freshman in Rangeland Ecology and Management from Adair, OK.

Matthew Allen Scheidt Endowed Memorial Scholarship
Matthew Scheidt majored in wildlife ecology and earned a bachelor's degree in 2001. Honoring Matt's life and love for OSU, his family created a memorial scholarship for students like Matt. The scholarship is awarded each year to a junior or senior in the wildlife or fisheries science options. Award to: **DESIREE WILLIAMS**, Senior in Wildlife Ecology and Management from Tulsa, OK.

Walker Merit Awards
The Walker Merit Awards were established by the estate of Nat and Helen Walker. Nat Walker was a long time Forestry faculty member and was an inspiration to many forestry students. The Walker scholarships are awarded yearly to a qualified, full-time student in a forestry option in NREM. Award to: **EMALEE TRACY**, Freshman studying in the Forest Ecology and Management from Kansas City, KS; **AMANDA THOMAS**, Senior in Forest Ecology and Management from Bartlesville, OK; and **JORIS BIDDICK**, Junior in Forest Ecology and Management from Norman, OK.

Rigdon Memorial Scholarship
This scholarship memorializes Harry P. Rigdon, Oklahoma's first Extension Forester (1940). He worked in extension and taught forestry at OSU until he passed away in 1959. Established in 1982 by Rigdon's sister Vera and his son Melvin, the scholarship is awarded to a sophomore in Forestry. Award to: **JAMES T ALLEN**, Senior in Forest Ecology and Management from Oklahoma City, OK.

Engle Scholarship
The Dave and Debra Engle Endowment Fund provide funds to be used for CASNR scholarships for full-time students majoring in Rangeland Ecology & Management or Fire Ecology & Management. Dr. and Mrs. Engle established the fund through a donation in 2001 and the first awards were made in 2008. Dave and Debra are her to help make the award. Award to: **JACK TIDWELL**, Junior in Rangeland Ecology and Management from Marlow, OK.

Ron and Sandra Jarman Outstanding Fisheries Undergraduate Award
This scholarship, funded by Ron and Sandra Jarman, recognizes Fisheries and Aquatic Ecology students. They must be actively involved with the Student Chapter of American Fisheries Society, or be actively involved in professional activities and have a minimum 3.0 GPA. This year we are

giving out two awards. Award to: **DANCI JOHNSTON**, Junior in Fisheries and Aquatic Ecology from Perkins, OK.

Glen R. Durrell Forestry Alumni Association Scholarship

This scholarship was established by the Forestry Alumni Association to memorialize Glen R. Durrell, the first professor and Head of the OSU Forestry Department. It is awarded annually to the outstanding senior forestry student based on scholarship, character, and potential for leadership. Award to: **CLINT WARDLOW**, Senior in Forest Ecology and Management from Yukon, OK.

Dave & Merna Jo Robinson Award

Established in 1991 by OSU Forestry faculty, alumni and friends, this award honors Dr. Dave Robinson for 29 years of dedicated and enthusiastic service to the Forestry Department and forestry profession. The award recognizes a senior who has demonstrated "special achievement" not solely related to academic performance, encouraging professional development, activity and involvement outside the classroom. Award to: **MATTHEW DELOZIER**, Senior in Forest Ecology and Management from Haworth, OK.

GRADUATE STUDENT FELLOWSHIPS, AWARDS AND SCHOLARSHIPS

Robert L. Lochmiller ll Endowed Scholarship in Wildlife Ecology

Bob Lochmiller served as professor in the Department of Zoology at OSU from 1985 until his untimely death in 2000. His high-level research involved wildlife ecology, toxicology, and immunology. Bob generously involved many colleagues at OSU in his varied and energetic research projects. The Lochmiller Award was established by Bob's wife and family to honor his sense of scholarship and his joy of research. These scholarships are based on scholarship and excellence in research. Award to: **DILLON FOGARTY**, an M.S. candidate in Wildlife Ecology from Belle Plaine, Minnesota (advisor Dr. Scott Loss); and **DAN DVORETT**, a Ph. D candidate in Wildlife Ecology from East Meadow, New York (advisor Dr. Craig Davis).

Outstanding Fisheries Graduate Student Scholarship

This award recognizes special achievement in academics, research and involvement in departmental, university, or professional activities by a graduate student in Natural Resource Ecology and Management, Fisheries and Aquatic Ecology. The student must be active in the American Fisheries Society to be eligible for the award. Award to: **ROBERT MOLLENHAUER**, a Ph.D. Candidate in Fisheries and Aquatic Ecology from Chicago, Illinois (advisor Dr. Shannon Brewer).

Sally Jo Bible Graduate Student Awards

This graduate student award was established through a donation by Mrs. Sally Jo Bible to support a program of research and education in forestry and the management of wildlife and natural resources. The fund honors overall excellence in graduate student in NREM. Award to: **KATHERINE GOLDEN**, a Ph.D candidate in Wildlife Ecology from Woodbridge, Virginia (advisors Drs. Craig Davis and Sam Fuhlendorf).

Afanasiev Distinguished Graduate Fellowship

The Afanasiev recipient must be working in or accepted in the graduate degree program and working on a forestry research tropic to be eligible for this graduate fellowship. Eugenia Afanasiev was the widow of Dr.

Michel Afanasiev a professor in the forestry department at OSU. Eugenia wanted to express her gratitude for the gifts of love and friendship they received in Stillwater and to honor her husband and his profession. The fund was established in 1982. Award to: **WILLIAM HARGES**, an M.S. candidate in Forest Resources from Pryor, OK (advisor Dr. Tom Lynch), **VANESSA NUNES-BIRAL**, an M.S. candidate in Forest Resources from Sao Paulo, Brazil (advisor Dr. Rod Will); and **DANIELLE TECHENTIN**, a Ph.D. candidate in Wildlife Ecology from Rochester, Minnesota (advisor Dr. Sue Fairbanks).

Williams Distinguished Graduate Fellowship

The distinguished graduate fellowship recipients are required to be post baccalaureate students, enrolled full time at Oklahoma State University. The DGF is a one-year award. However, past recipients are eligible to be re-selected to continue receiving the DGF for a maximum of 3 years of graduate level or higher study. Award to: **JACOB DYER**, a Ph.D candidate in Forest Resources from Denver, Colorado (advisor Dr. Rod Will); **KATHERINE GOLDEN**, a Ph.D candidate in Wildlife Ecology from Woodbridge, Virginia (advisors Drs. Craig Davis and Sam Fuhlendorf); **CAITLIN LAUGHLIN**, an M.S. candidate in Forest Resources from Logan, Utah (advisors Dr. Steve Hallgren and Dr. Tim O'Connell); and and **DANIELLE TECHENTIN**, a Ph.D. candidate in Wildlife Ecology from Rochester, Minnesota (advisor Dr. Sue Fairbanks).

MURRAY-GRAY UNIT SERVICE AWARD

The Murray-Gray Unit Service Award is presented annually to any individual(s) who demonstrates exceptional service and dedication to the mission of the Oklahoma Cooperative Fish and Wildlife Research Unit. (OKCFWRU). The award is named after Helen L. Murray and Judy M. Gray, who together gave 70 combined years of service to the Oklahoma Unit and OSU. Recipients can be selected from inside or outside OSU. Award to: **CHERYL MCKNIGHT**, Accounting Specialist, OKCFWRU, Stillwater.

April 2016

Craig Davis Awarded Texas Tech Univ. Dept. of Natural Resources Management 2016 Outstanding Alumnus Award

Dr. Craig Davis was awarded the Texas Tech University Department of Natural Resources Management Outstanding Alumnus Award. Dr. Davis graduated with his PhD in Wildlife Science from TTU in 1996 and has become a national leader in wetland wildlife ecology. Congrats Craig!!

April 2016

Gail Wilson Wins Outstanding Graduate Coordinator Award

NREM's Dr. Gail Wilson received the 2016 Outstanding Graduate Coordinator at the graduate College at the OSU Graduate College "Thank-You Breakfast" on April 13, 2016. Dr. Wilson tirelessly manages many of the departmental administrative duties associated with graduate students that are recruited in to NREM faculty research and extension programs.

NREM maintains about 60 PhD and MS level graduate students. Advising includes in-processing, graduate degree checks, serving as liaison between advisor and student, and preparing and updating the Graduate Student Handbook which is distributed at an orientation meeting each Fall semester.

As Dr. Cynda Clary, Associate Dean of CASNR wrote in an email on that day, "Great job, Gail! Thank you for the time you have invested in our students!"

May 2016

Forestry Field Camps a Success

Our May camps continue to go well! As you recall, we run our overall camp program as two distinct May offerings. Our sophomores participate in our "Oklahoma Camp" at OSU's Kiamichi Forestry Research Station in Idabel, Oklahoma, where the focus is forest field ecology and management, and forest measurements. Concurrently, our junior students are engaged in our out-of-state camp in the Rocky Mountains of New Mexico where we take a broad view of natural resources, their ecology, and their management to serve a diversity of uses, values, good and services.

Both programs start immediately following spring semester final exams, and run three weeks through the rest of May, thereby affording our students the opportunity for gainful summer jobs and internships for the remainder of the summer. Before they graduate students who choose the NREM forestry option garner six weeks of field camp experience. Camp has always been a hallmark of the Forestry undergraduate option at OSU, and it continues to serve as a principal motivator for our students. Our data shows that virtually every Forestry student that completes our camp program ultimately graduates and enters the professional Forestry workplace. As all of you routinely attest, camp is a major highlight of our Forestry academic experience at OSU.

Drs. Rod Will and Tom Lynch taught the two courses that comprise the Oklahoma camp. Instruction focused on the dynamics of forest ecosystems, applications of silvicultural practice, timber cruising, forest inventory, and log scaling. As we do each year, we relied on the resources of the Ouachita National Forest, Weyerhaeuser

Company, Oklahoma Department of Wildlife Conservation, US Fish & Wildlife Service, and the OSU Lindley property for our fieldwork. We appreciate the folks over at the Kiamichi Forestry Research Station for accommodating us well during our camp, as always, and also extend thanks to the members of the Stateline Chapter of the Society of American Foresters for hosting a cookout for our students and faculty during camp.

Our New Mexico camp program moved about the north-central part of that state, as usual, using several locations as home bases for a few days. We had a diverse program with lots of practical hands-on opportunity at places including Carson National Forest, Rio Mora National Wildlife Refuge, Vermejo Park Ranch, Fishtail Ranch, Mora National Fish Hatchery, Jicarilla Wild Horse Territory, the community of Las Trampas, and three units of the National Park System including Chaco Canyon, Bandelier, and Capulin Volcano. The program emphasized integrated multi-resource management with experiences in timber, water, wildlife, fish, range, recreation, cultural resources, and ecosystem restoration, spanning a range of habitats from the high desert shrub, pinyon-juniper, and ponderosa pine of the lower country, to the higher elevation aspen, Douglas-fir, Engelmann spruce and bristlecone pine, right up to the alpine tundra. As usual, our New Mexico Forestry campers had a taste of Rocky Mountain snow during what we still affectionately call "summer camp," even though we are back at home before summer actually begins! I again led this camp as the sole instructor, and relied on the active participation and involvement of several professionals from the various natural resource agencies and the private sector.

Once again, our Forestry students benefitted from the generous scholarship support of the Allene Brown Foundation and Carolyn Jacob Foutch. We very much appreciate their continued financial support which enables our students to forgo a few weeks of summer employment in order to participate in our camp programs!
---Tom Kuzmic, Camp Director (camp #36)

July 2016

Summer Fire Field Day

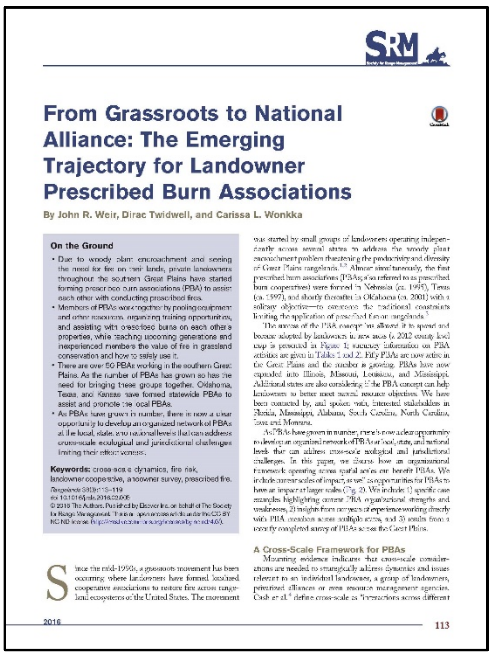
About 100 attended the summer fire field day by the red barn north of Stillwater, OK in July 2016. John Weir, NREM Research Associate and Fire Instructor, put on the demonstration with help from current and former students. A nice article about the field day was written for the Perry Daily Journal by Mary Waters Bunch with many pictures (shown below).
---Jim Ansley


Perry Daily Journal
PDJ
The Heartbeat of Noble County
Friday, July 29, 2016
Growing season prescribed burn a success
110 attend workshop on Bunch Farm

July 2016

Extension Highlight: Prescribed Burning Associations Growing

NREM Research Associate John Weir and other published a paper entitled. "From Grassroots to National Alliance: The Emerging Trajectory for Landowner Prescribed Burn Associations" in *Rangelands*, a lay oriented journal. Portions of the abstract are reprinted here:



SRM

From Grassroots to National Alliance: The Emerging Trajectory for Landowner Prescribed Burn Associations

By John R. Weir, Dirac Twidwell, and Carissa L. Wonkka

On the Ground

- Due to woody plant encroachment and seeing the need for fire on their lands, private landowners throughout the southern Great Plains have started forming prescribed burn associations (PBA) to assist each other with conducting prescribed fires.
- Members of PBAs work together by pooling equipment and other resources, organizing training opportunities, and assisting with prescribed burns on each other's properties, while teaching upcoming generations and inexperienced members the value of fire in grassland conservation and how to safely use it.
- There are over 50 PBAs working in the southern Great Plains. As the number of PBAs has grown so has the need for bringing these groups together. Oklahoma, Texas, and Kansas have formed statewide PBAs to assist and promote the local PBAs.
- As PBAs have grown in number, there is now a clear opportunity to develop an organized network of PBAs at the local, state, and national levels that can address cross-scale ecological and jurisdictional challenges limiting their effectiveness.

Keywords: cross-scale dynamics, fire risk, landowner cooperative, landowner survey, prescribed fire.

Rangelands 38(3):113–119
doi 10.1016/j.rala.2016.02.005
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Since the mid-1990s, a grassroots movement has been occurring where landowners have formed localized cooperative associations to restore fire across rangeland ecosystems of the United States. The movement was started by small groups of landowners operating independently across several states to address the woody plant encroachment problem threatening the productivity and diversity of Great Plains rangelands.[1,2] Almost simultaneously, the first prescribed burn associations (PBAs; also referred to as prescribed burn cooperatives) were formed in Nebraska (ca. 1995), Texas (ca. 1997), and shortly thereafter in Oklahoma (ca. 2001) with a solitary objective—to overcome the traditional constraints limiting the application of prescribed fire on rangelands.[3]

The success of the PBA concept has allowed it to spread and become adopted by landowners in new areas (a 2012 county level map is presented in Figure 1; summary information on PBA activities are given in Tables 1 and 2). Fifty PBAs are now active in the Great Plains and the number is growing. PBAs have now expanded into Illinois, Missouri, Louisiana, and Mississippi. Additional states are also considering if the PBA concept can help landowners to better meet natural resource objectives. We have been contacted by, and spoken with, interested stakeholders in Florida, Mississippi, Alabama, South Carolina, North Carolina, Iowa and Montana.

As PBAs have grown in number, there is now a clear opportunity to develop an organized network of PBAs at local, state, and national levels that can address cross-scale ecological and jurisdictional challenges. In this paper, we discuss how an organizational framework operating across spatial scales can benefit PBAs. We include current scales of impact, as well as opportunities for PBAs to have an impact at larger scales (Fig. 2). We include: 1) specific case examples highlighting current PBA organizational strengths and weaknesses, 2) insights from our years of experience working directly with PBA members across multiple states, and 3) results from a recently completed survey of PBAs across the Great Plains.

A Cross-Scale Framework for PBAs

Mounting evidence indicates that cross-scale considerations are needed to strategically address dynamics and issues relevant to an individual landowner, a group of landowners, privatized alliances or even resource management agencies. Cash et al.[4] define cross-scale as "interactions across different

2016 113

Due to woody plant encroachment and seeing the need for fire on their lands, private landowners throughout the southern Great Plains have started forming prescribed burn associations (PBA) to assist each other with conducting prescribed fires.

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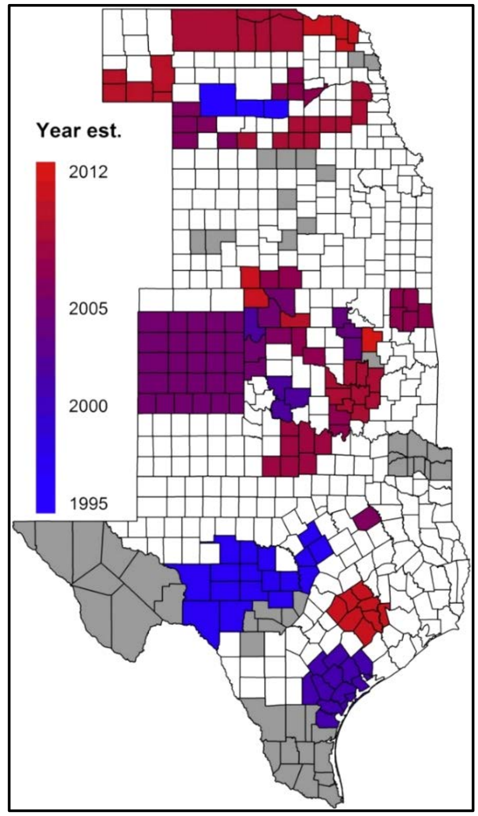
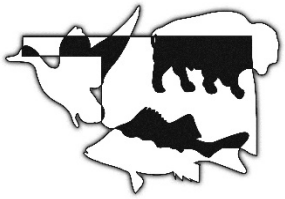


One of the figures showing growth of PBA's. Gray indicates that year of establishment was not known.

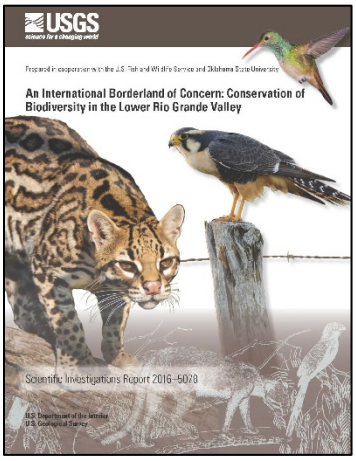
As PBAs have grown in number, there is now a clear opportunity to develop an organized network of PBAs at the local, state, and national levels that can address cross-scale ecological and jurisdictional challenges limiting their effectiveness.

July 2016

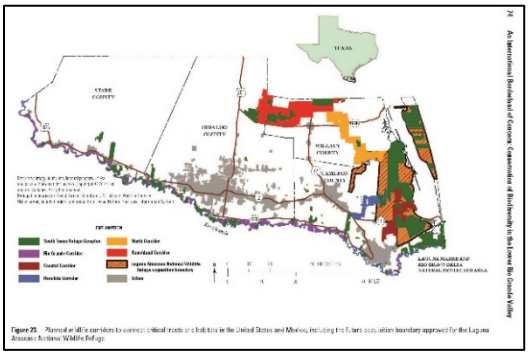
Research Highlight: Conserving Biodiversity in the Lower Rio Grande Valley



OKCFWRU Coop Unit Leader Chip Leslie recently authored a 136 page USGS publication entitled "An International Borderland of concern: Conservation of Biodiversity in the Lower Rio Grande Valley" that synthesized habitat concerns in south Texas as affected by urbanization and other factors. Portions of the abstract are reprinted here:



The Lower Rio Grande Valley (LRGV) of southern Texas is located on the U.S.–Mexican borderland and represents a 150-mile linear stretch that ends at the Gulf of Mexico. It represents unique transition between temperate and tropical conditions and, as such, sustains an exceptionally high diversity of plants and animals—some of them found in few, or no other, places in the U.S. Examples include the northern ocelot (*Leopardus pardalis albescens*) and northern aplomado falcon (*Falco femoralis septentrionalis*)—both endangered in the U.S. and emblematic of the LRGV. The U.S. Fish and Wildlife Service (USFWS) manages 3 national wildlife refuges that together make up the South Texas Refuge Complex whose mission actively conserves biodiversity in about 189,841 acres of native riparian and upland habitats in the LRGV. These diminished habitats harbor many rare, threatened, and endangered species. This report updates the 1988 USFWS report titled "Tamaulipan brushland of the Lower Rio Grande Valley of south Texas: Description, human impacts, and management options," by synthesizing nearly 400 peer-reviewed scientific publications.



Map of the LRGV showing proposed wildlife corridors

Without a doubt, the LRGV faces every contemporary conservation challenge of the 21st century, but ongoing human population growth and its associated demands, international border issues, and oil-and-gas and alternative energy development come to dominate impacts that effect conservation in the LRGV. Continued careful syntheses of existing and future information collected in the LRGV are needed on many biological and sociological topics to guide conservation activities.

July/August 2016

Travel Abroad – Peru

I led our first OSU trip to Peru in the late summer, 2016. With the seasons in reverse in the southern hemisphere, we were greeted with cool days and cold nights, and glad to be free of the 100 degree dry days of Oklahoma! Our first days were spent exploring Cusco, the historic center of Inca civilization in the 1400s, and then later a bastion of the conquering Spanish. We visited several Inca ruins in the "Sacred Valley" including Pisac, Sacsayhuaman, Moray, Ollantaytambo, and the majestic Machu Picchu…we had to take a train to get to the nearest community, and then a winding bus-ride up to the knife-edge ridge where the Inca created Machu Picchu, surely their most wondrous work of masonry. Their stone craftsmanship is simply spell-binding, withstanding the rigors of weather, earthquakes, and plundering through time. Our guides deftly escorted us through time and wonder with captivating stories of Inca lore and their ultimate demise during the era of the Spanish Conquest, though their present-day descendants, the Quechua people, continue to live in some of the ancient Inca stone villages and farm the steep-coursed Inca terraces high in the mountains.

We progressed further south across the Andean altiplano, crossing some passes at over 15,000 feet (gulp!) and observed herds of alpaca, llamas, and the endangered vicuña, grazing a landscape dotted with volcanoes ascending above 20,000 feet.

At Colca Canyon, we gazed at the majestic Andean Condor soaring above us sometimes just 50-100 feet away. The altiplano is simply *surreal*.

We visited the floating-reed Uros Islands out in Lake Titicaca, the world's highest navigable lake (situated at about 12,000 feet), and then home-stayed with Quechua families on Amantani Island, experiencing a simpler and slower pace of life…no roads, cars and trucks there, and little in the way of mechanization. Our hosts were exceptionally friendly and accommodating, and we all pitched in with the daily tasks in the home and on the pre-Inca terraced farms. Late one afternoon, we climbed to the high point of the island and engaged in a purification ceremony with the principal shaman…the sage and healer of the island…he delved a little *into our futures*. Lake Titicaca is vivid blue, bracing, stunning, and huge…and from our vantage on the island's summit, we gazed across the waters to the snow and ice-clad Andean summits framing the Bolivian side of the shoreline, and experienced a dramatic sunset. Later, trodding down the cobblestone walkways by flashlight back to the village, we donned wool ponchos and danced to the music of Andean panpipes, charangos and guitars…and imbibed a bit of the national hooch…Pisco….and something else I can't remember…*hmmmmmm.*

Amazing journeys, amazing places, amazing people, amazing memories. Someone once said, "Do something good for your country…LEAVE!" But then of course, we return back home with fresh and expanded insight and understanding about the world and its diverse people, and

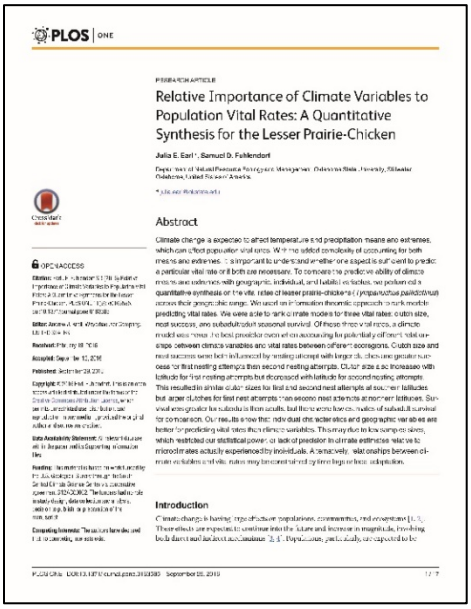
perhaps come to a realization that sometimes, *simple is better,* and that we in the USA may not necessarily have all the answers…and hopefully are *"the better"* for it!
---Tom Kuzmic

September 2016

NREM Research Highlight: Climate Variables and the Lesser Prairie-Chicken

An interesting paper was published in *PLOS One* by **Julia Earl** and **Sam Fuhlendorf** entitled "Relative Importance of Climate Variables to Population Vital Rates: A Quantitative Synthesis for the Lesser Prairie-Chicken". The abstract is reprinted here:

Climate change is expected to affect temperature and precipitation means and extremes, which can affect population vital rates. With the added complexity of accounting for both means and extremes, it is important to understand whether one aspect is sufficient to predict a particular vital rate or if both are necessary. To compare the predictive ability of climate means and extremes with geographic, individual, and habitat variables, we performed a quantitative synthesis on the vital rates of lesser prairie-chickens (*Tympanuchus pallidictinus*) across their geographic range. We used an information theoretic approach to rank models predicting vital rates. We were able to rank climate models for three vital rates: clutch size, nest success, and subadult/adult seasonal survival. Of these three vital rates, a climate model was never the best predictor even when accounting for potentially different relation- ships between climate variables and vital rates between different ecoregions. Clutch size and nest success were both influenced by nesting attempt with larger clutches and greater success for first nesting attempts than second nesting attempts. Clutch size also increased with latitude for first nesting attempts but decreased with latitude for second nesting attempts.


PLOS ONE

RESEARCH ARTICLE

Relative Importance of Climate Variables to Population Vital Rates: A Quantitative Synthesis for the Lesser Prairie-Chicken

Julia E. Earl*, Samuel D. Fuhlendorf

Abstract

Introduction

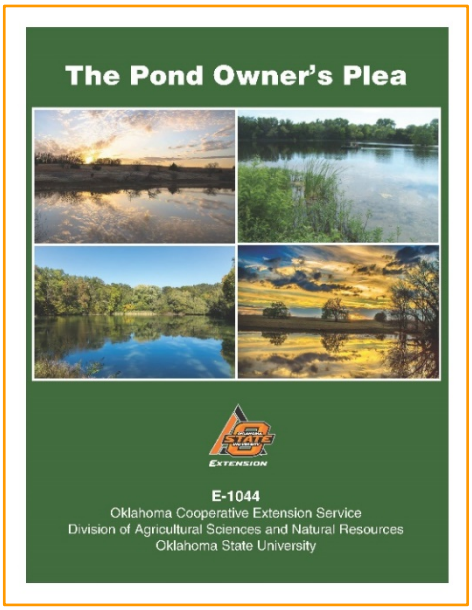
This resulted in similar clutch sizes for first and second nest attempts at southern latitudes but larger clutches for first nest attempts than second nest attempts at northern latitudes. Survival was greater for subadults than adults, but there were few estimates of subadult survival for comparison. Our results show that individual characteristics and geographic variables are better for predicting vital rates than climate variables. This may due to low samples sizes, which restricted our statistical power, or lack of precision in climate estimates relative to microclimates actually experienced by individuals. Alternatively, relationships between climate variables and vital rates may be constrained by time lags or local adaptation.

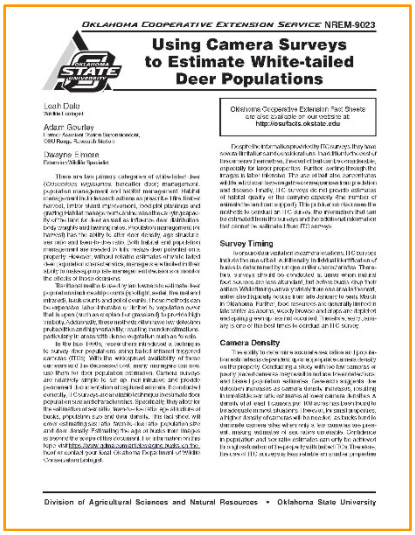
September 2016

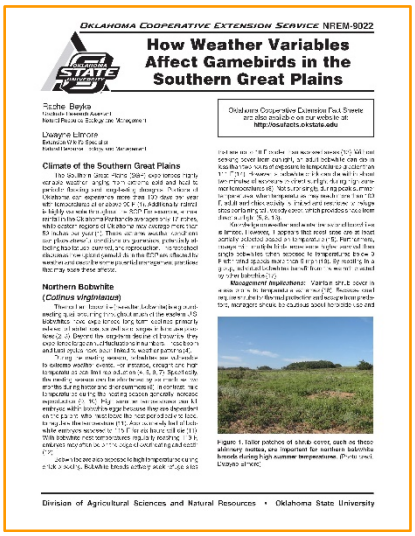
NREM Extension Highlights – New Fact Sheets

Each year NREM produces several new Extension Fact Sheets. These are available on our NREM web site our departmental web site http://nrem.okstate.edu. And also on the OSU Extension web site http://pods.dasnr.okstate.edu/docushare/dsweb/HomePage.

A few of note this year are Marley Beem's aesthetically beautiful, "The Pond Owner's Plea." and two under the supervision of Dwayne Elmore, Leah Dale's "Using Camera Surveys to estimate White-tailed Deer Populations" and Rachel Beyke's "How Weather Variables Affect Gamebirds in the Southern Great Plains." John Weir was also a co-author on a Southern Fire exchange Fact Sheet entitled, "The Value of Forming a Prescribed Burn Association." Please check out these very informative publications.







September 2016

Dave Engle Retirement

Long time OSU rangeland ecologist Dr. Dave Engle retired from the NREM department in September, 2016. A farewell gathering for Dave was held on September 29 in Ag Hall.

Starting in OSU Plant and Soil Science Dept. early 1980's

Now – the glasses are gone but the hairline and smile are not!

Dave was presented with a DASNR triangle plaque by Dr. Keith Owens, OAES Associate Dean. Jim Ansley then presented some gifts to Dave from donations by NREM faculty, including a top of the line fly fishing rod and reel. Dr. Ansley also spoke of Dave's contribution to the rangeland science discipline and how he and a handful of other range scientists moved the science from what was initially fairly undisciplined observations to truly cutting edge science. Congrats Dave on a fantastic career!

October 2016

Pushmataha Field Day

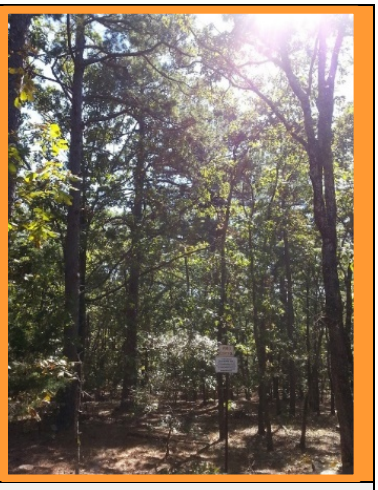
About 100 participants gathered at the Pushmataha Wildlife Management Area near Clayton, OK on October 11, 2016 for a Field Day to observe effects of the long-term fire management treatments that have been imposed on the Shortleaf pine and hardwood forest there.

We toured several different treatments with our hosts, Jack Waymire, Senior Wildlife Biologist and faculty from the OSU Natural Resource Ecology and Management Department, John Weir, Dwayne Elmore and Laura Goodman. It was interesting to see how different thinning treatments and fire frequencies imposed since 1985 affected the over- and understory species diversity.

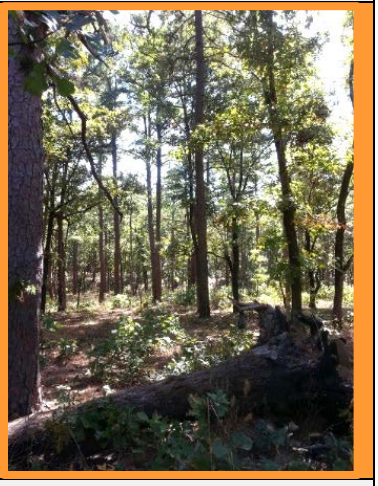
Jack Waymire, Senior Wildlife Biologist, ODWC, showing the 4-year fire treatment and pointing out the increased understory growth.

The unburned controls, as expected, had nearly closed canopy pine and hardwood overstory with only litter on the forest floor. Eastern redcedar was also beginning to invade. A fire every 4 years slightly opened this canopy generating some understory growth – mainly hardwood sprouting. More frequent fires, once every 1, 2 or 3 years, as well as some selective thinning of hardwoods in certain treatments, sometimes

with stem injections, created a variety of mixed tree and grassland vegetation.



Unburned Control



Fire every 4 years

Fire every 2 years

One large area had been burned and thinned into a very attractive shortleaf pine savanna. Shortleaf pine, being very fire resistant, tolerated frequent fires.

Shortleaf pine savanna maintained by frequent prescribed fire.

Conversations among the presenters and the group revolved around which treatment might be best for wildlife habitat or a combination of timber harvest and wildlife production. The presenters did a wonderful job engaging the participants in these group conversations.

John Weir, Research Associate and Fire Ecologist, OSU-NREM Department, points out some features in one of the frequent fire treatments.

I also had the opportunity to visit with several of Dr. Rod Will's forestry graduate students, including some from Brazil, who attended the tour. They were there to collect field data on the plots for a few days after

the tour. Also in attendance were Bob Heinemann and Casey Meeks from the OSU Idabel Forest Resources Center.

Dr. Dwayne Elmore, Wildlife Extension, OSU-NREM Department, discusses grass restoration as a result of frequent burning since 1985.

The project was initiated by Dr. Ron Masters and Jack Waymire in 1985 and they, along with many others, have gathered a massive data set that provides one of the best long-term account of what happens to this forested ecosystem over time with various thinning and fire treatments, all on basically the same soil type.
--- Jim Ansley

October 2016

Dwayne Elmore Part of Group Achievement Award at National Wildlife Society Meeting

Dr. Dwayne Elmore was part of a multi-state team that received the **Group Achievement Award** at The Wildlife Society national meeting in Raleigh, NC in October, 2016. The award was presented for their work on "The Utah Community Based Conservation Program." Other members of the team included team leader, Dr.Terry Messmer, along with D.K. Dahlgren, S.N. Frey, and S. Lupis. Congratulations Dwayne!

October 2016

NREM Research Highlight: Earthworms are Not Always Good for the Soil

They are everywhere. People use them as fishing bait. Others toss them in their gardens to help aerate the soil. They also can be used in compost piles. They are earthworms and with them come many misconceptions. The truth of the matter is sometimes earthworms can be invasive and cause significant environmental damage.

Researchers within Oklahoma State University's Department of Natural Resource Ecology and Management recently dug into this issue through a grant from the United States Department of Defense. The funding led Shishir Paudel, NREM post-doctoral associate, to a U.S. Navy-owned island 80 miles off the coast of California.

San Clemente Island is a remote, windswept, rugged island off the coast of southern California, with numerous unique and endangered plant and animal species, and until recently, no earthworms. When the Navy did find earthworms on the only ship-to-shore, live-firing range in the country, they became concerned about potential harmful effects to endangered species, and Paudel and his colleagues also took interest.

"Based on our research, we're still not certain how the worms got there, but we think they were likely introduced in 2008, when topsoil was brought from the mainland to pave a major road," Paudel said.

The team was led by Scott Loss, NREM Assistant Professor, and included collaboration from Gail Wilson, NREM Sarkeys Endowed professor, and researchers from the University of Southern California. The research, which began in 2014, was recently published in the journal *Diversity and Distributions*.

Collecting earthworm samples

Paudel did a random sample of the island, digging 672 holes, all of which were 33 cm by 33 cm square and 30 cm deep. He found anywhere from 0 to more than a dozen worms in each hole. The worms were taken back to Oklahoma to be identified, and all were found to be native to either Eurasia or South America.

Finding worms where they are not supposed to be does not sound like a big deal. But, much research has been done on invasive earthworms in forests of the northern United States, areas that were historically earthworm-free due to glaciation.

"Ecologists have learned that Eurasian earthworms drastically change the entire forest ecosystem," said Loss. "Earthworms change the soil, which in turn reduces biodiversity of forest plants. Changes to vegetation can even negatively affect populations of animals, like birds and salamanders living on the forest floor."

On San Clemente Island, the research team found some evidence of harmful impacts to grassland ecosystems. In particular, invasive grasses were more common in areas with invasive earthworms, suggesting that earthworms may be helping invasive plants establish a foothold.

Loss and his students also have documented invasive earthworms in Oklahoma soils. The team is hopeful the research in California will open the eyes and minds of those moving dirt for construction purposes without thinking about possible harmful effects to the environment. Likewise, fishermen in Oklahoma and elsewhere can prevent environmental damage by throwing away unused bait rather than dumping it on the ground.

---Sean Hubbard, Communications Specialist, OSU

October 2016

Virginia Tech's Donald J. Orth Honored by the American Fisheries Society

Donald J. Orth, the Thomas H. Jones Professor in Virginia Tech's College of Natural Resources and Environment, has been named a Fellow of the American Fisheries Society and received the society's Excellence in Fisheries Education Award which is presented to members who have demonstrated excellence in organized teaching and advising in some aspect of fisheries education. Orth received his bachelor's from Eastern Illinois University and his master's and doctorate from Oklahoma State University. He has been a faculty member at Virginia Tech since 1980 and has received a number of university teaching awards.

NREM Research Highlight: Extreme Climate and Northern Bobwhite Survival

Post-doctoral Fellow Even Tanner, along with NREM faculty co-authors Dwayne Elmore, Sam Fuhlendorf and Craig Davis recently published a paper entitled, "Extreme Climatic Events Constrain Space Use and Survival of a Ground-Nesting Bird" in *Global Change Biology*, a very prestigious international journal. Some text from the Abstract is shown here:

Recently, a growing body of literature has identified thermal stress as a potential mechanism in determining space use and survival. We sought to determine how ambient temperature at fine temporal scales affected survival and space use for a ground-nesting quail species (*Colinus virginianus*; northern bobwhite).

Global Change Biology (2016), doi: 10.1111/gcb.13505

Extreme climatic events constrain space use and survival of a ground-nesting bird

EVAN P. TANNER[1], R. D. ELMORE[1], SAMUEL D. FUHLENDORF[1], CRAIG A. DAVIS[1], DAVID K. DAHLGREN[2] and JEREMY P. ORANGE[1]

[1]Department of Natural Resource Ecology and Management, Oklahoma State University, Stillwater, OK 74078, USA,
[2]Department of Wildland Resources, Utah State University, 5230 Old Main Hill, Logan, UT 84322, USA

Abstract

Two fundamental issues in ecology are understanding what influences the distribution and abundance of organisms through space and time. While it is well established that broad-scale patterns of abiotic and biotic conditions affect organisms' distributions and population fluctuations, discrete events may be important drivers of space use, survival, and persistence. These discrete extreme climatic events can constrain populations and space use at fine scales beyond that which is typically measured in ecological studies. Recently, a growing body of literature has identified thermal stress as a potential mechanism in determining space use and survival. We sought to determine how ambient temperature at fine temporal scales affected survival and space use for a ground-nesting quail species (*Colinus virginianus*; northern bobwhite). We modeled space use across an ambient temperature gradient (ranging from −20 to 38 °C) through a MAXENT algorithm. We also used Andersen–Gill proportional hazard models to assess the influence of ambient temperature-related variables on survival through time. Estimated available useable space ranged from 18.6% to 57.1% of the landscape depending on ambient temperature. The lowest and highest ambient temperature categories (<−15 °C and >35 °C, respectively) were associated with the least amount of estimated useable space (18.6% and 24.6%, respectively). Range overlap analysis indicated dissimilarity in areas where *Colinus virginianus* were restricted during times of thermal extremes (range overlap = 0.38). This suggests that habitat under a given condition is not necessarily a habitat under alternative conditions. Further, we found survival was most influenced by weekly minimum ambient temperatures. Our results demonstrate that ecological constraints can occur along a thermal gradient and that understanding the effects of these discrete events and how they change over time may be more important to conservation of organisms than are average and broad-scale conditions as typically measured in ecological studies.

Keywords: Andersen–Gill model, climate change, *Colinus virginianus*, Maxent, temperature

Received 4 April 2016; revised version received 6 September 2016 and accepted 13 September 2016

Introduction

Two fundamental issues in ecology are understanding what influences the distribution and abundance of organisms (Krebs, 1985). Resource bottlenecks have been suggested as potential limiting periods in which resources for an organism are restricted, which can influence the size and distribution of populations (Maron *et al.*, 2015). These periods of resource bottlenecks have been linked to extreme climatic events (ECEs) and stochastic perturbations that populations are exposed to (Parmesan *et al.*, 2000; Maron *et al.*, 2015). However, how researchers define spatial and temporal scales is important and can influence our understanding of how extreme events can directly affect organisms (Mooij *et al.*, 2002). At fine temporal and spatial scales, resource use is highly dynamic and can vary based on the availability of other necessary resources (Mooij *et al.*, 2002; Beerens *et al.*, 2015), environmental conditions (Mooij et al., 2002; Hovick et al., 2014; Carroll et al., 2015a), or with biotic interactions (Ryder & Sillett, 2016). These patterns may exist at smaller scales of resolution than typically studied (Dunbar et al., 2009; Maron *et al.*, 2015), and as a result, extreme events may facilitate changes in space use and/or survival at both fine temporal (Carroll *et al.*, 2015a) and spatial (Hovick *et al.*, 2014) scales. Understanding how extreme events can lead to constraints in space use and/or survival (i.e., an ecological constraint) across scales is a high priority in the context of climate change.

It is important to explicitly define what constitutes an ECE within the context of specific research objectives to facilitate comparisons across studies (Smith, 2011; Bailey & van de Pol, 2016). Here, we combine both climatological and biological definitions of ECEs, in which ECEs are events where the conditions occurring are

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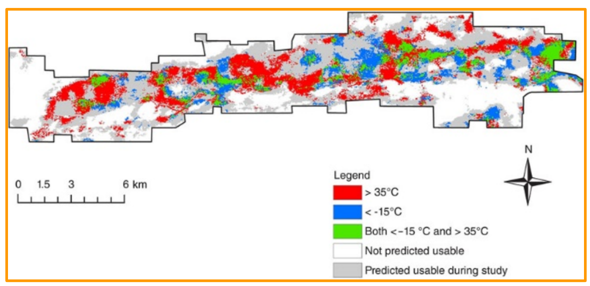
We modeled space use across an ambient temperature gradient (ranging from -20 to 38 °C) through a MAXENT algorithm. We also used Andersen–Gill proportional hazard models to assess the influence of ambient temperature-related variables on survival through time. Estimated available useable space ranged from 18.6% to 57.1% of the landscape depending on ambient temperature. The lowest and highest ambient temperature categories (<−15 °C and >35 °C, respectively) were associated with the least amount of estimated useable space (18.6% and 24.6%, respectively). Range overlap analysis indicated dissimilarity in areas where *Colinus virginianus* were restricted during times of thermal extremes (range overlap = 0.38). This suggests that habitat under a given condition is not necessarily a habitat under alternative conditions. Further, we found survival was most influenced by weekly minimum ambient temperatures.



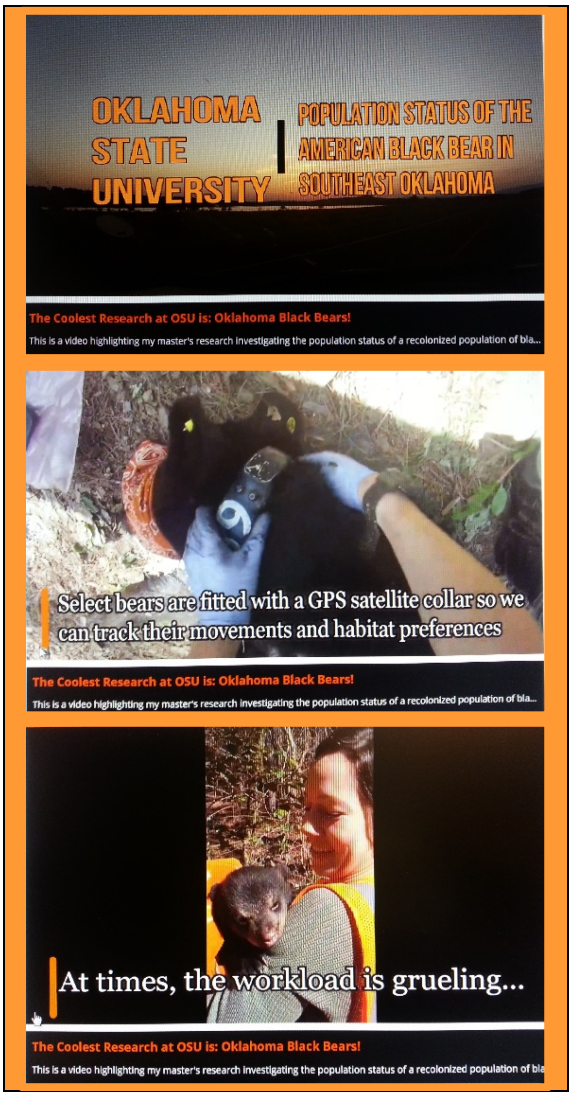
Actual useable space (colored) compared to predicted useable space (gray) as affected by temperature extremes.

Our results demonstrate that ecological constraints can occur along a thermal gradient and that understanding the effects of these discrete events and how they change over time may be more important to conservation of organisms than are average and broad-scale conditions as typically measured in ecological studies.

November 2016

NREM Grad Student Erica Perez Wins VPR's "Coolest OSU Research" Video Contest

NREM Masters student Erica Perez, won the VPR's Coolest OSU Research video contest this November with her video, "Population Status of the American Black Bear in Southeast Oklahoma". Photos below are some still shots from the video.



Erica won a $750 travel grant to attend a professional conference. The contest invited students to produce videos that showed how cool and passionate they are about their areas of research. ---Jeff Joiner, OSU Research Communications

November 2016

NREM Students, Faculty, and Staff Visit Aldo Leopold's Shack

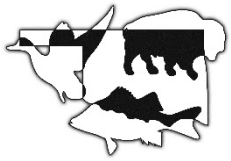
While attending the National Society of American Forester's convention in Madison, WI, NREM students, faculty, and staff visited the shack that Aldo Leopold and his family used as a weekend retreat.

Pictured (left to right); Dipesh K.C., Nathan Wade, Dan Hoff, J.T. Allen, Joris Biddick, Dr. Rod Will, Caren Mendonca, Giovanne Serraum, Dr. Omkar Joshi and Casey Meek.

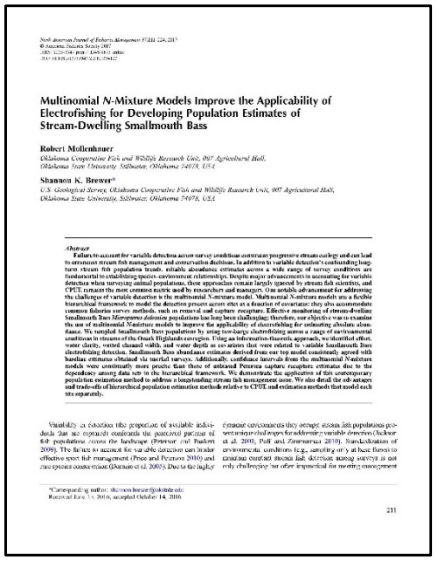
His time at the shack and efforts to restore the surrounding land inspired many of the ideas presented in his book "Sand County Almanac" and his vision for a 'land ethic'. MS student Dan Hoff previously worked for the Leopold Foundation and gave a private tour of the shack and surrounding area.

December 2016

Research Highlight: Modeling Smallmouth Bass Populations



PhD graduate student Robert Mollenhauer and his advisor, Coop scientist Dr. Shannon Brewer just published a paper entitled, "Multinomial N-Mixture Models Improve the Applicability of Electrofishing for Developing Population Estimates of Stream-Dwelling Smallmouth Bass" in the *North American Journal of Fisheries Management*. Highlights from the Abstract:



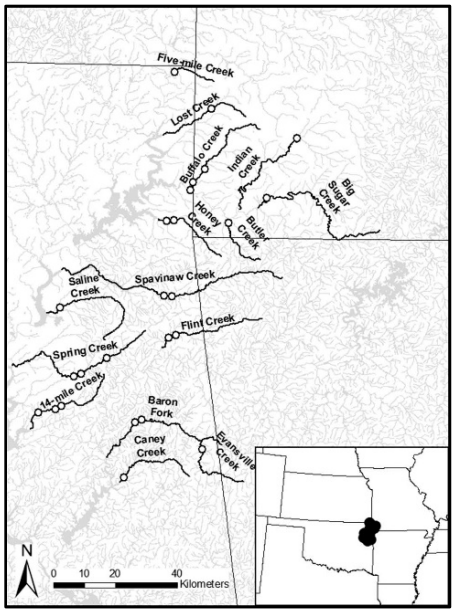
Multinomial *N*-Mixture Models Improve the Applicability of Electrofishing for Developing Population Estimates of Stream-Dwelling Smallmouth Bass

Robert Mollenhauer

Shannon K. Brewer*

Because effective monitoring of stream-dwelling Smallmouth Bass *Micropterus dolomieu* populations has long been challenging, our objective was to examine the use of multinomial *N*-mixture models to improve the applicability of electrofishing for estimating absolute abundance. We sampled Smallmouth Bass populations using tow-barge electrofishing across a range of environmental conditions in streams of the Ozark Highlands ecoregion.

Using an information-theoretic approach, we identified effort, water clarity, wetted channel width, and water depth as covariates that were related to variable Smallmouth Bass electrofishing detection. Smallmouth Bass abundance estimates derived from our top model consistently agreed with baseline estimates obtained via snorkel surveys.



Map showing stream sampling sites.

Additionally, confidence intervals obtained from the multinomial *N*-mixture models were consistently more precise than unbiased Petersen capture-recapture estimates due to the dependency among datasets in the hierarchical framework.

We demonstrate the application of a contemporary population estimation method to address a long-standing stream-fish management issue. We also detail the advantages and trade-offs of hierarchical population estimation methods relative to catch-per-unit-effort and estimation methods that model each site separately.

November 2016

NREM Cookout

On November 3, 2016, the NREM department put on an outdoor cookout for students and faculty on campus near Theta Pond. Members of the NREM student clubs, American Fisheries Society (Danci Johnston, President), OSU Range Club (Jack Tidwell, President), OSU Student Chapter of American Forestry Club (Rebekah Banks, President), OSU Student Chapter of the Wildlife Society (Kalynn Branham, President) and the NREM Graduate Student Organization (Caitlin Laughlin, President) helped put on the meal. About 75 attended. Unfortunately, I don't think any photos were taken! Suffice to say it was a very pleasant evening and a good chance for faculty and students to share some time.
---Jim Ansley

November 2016

NREM Student Clubs Very Active in 2016

Much of our work in the department would not be possible without the help of the NREM student clubs. We thank all who helped with recruiting events, job fairs, fund raising, the NREM cookout and all the duties associated within each of their clubs. We also thank their faculty advisors!! A listing of the club officers follows:

American Fisheries Society (AFS)

President	Danci Johnston
VP	Frances Marshall
Sec./Treas.	Desiree Williams
CASNR Rep	Deidra Ritchhart
Advisors	Dan Shoup and Jim Long

OSU Range Club

President	Jack Tidwell
VP	Dee Vandaveer
Secretary	Tanner Large
Treasurer	Andrew Mainini
Advisor	Karen Hickman

OSU Student Chapter of American Foresters Forestry Club

President	Rebekah Banks
VP	JT Allen
Secretary	Rachel VanFleet
Treasurer	Emalee Tracy
Historian	Skylar Snell
Advisor	Tom Kuzmic

OSU Student Chapter of The Wildlife Society

President	Kalynn Branham
VP	Andie Ford
Secretary	Shauna Folchert
Treasurer	Taylor Muller
Liaison	Jennifer Knutson
Historian	Wendi Ridings
Advisor	Sue Fairbanks

NREM Graduate Student Organization (NREM GSO)

President	Caitlin Laughlin
VP	Daniel Harrington
Secretary	Dray Carl
Treasurer	Cameron Duquette
GPSGA Reps	Nick Jaffe, Kate Golden
Advisor	Tim O' Connell

"The outstanding scientific discovery of the twentieth century is not television, or radio, but rather the complexity of the land organism."
— Aldo Leopold

November 2016

Anna O'Hare Receives OSU "Senior of Significance" Award

Anna O'Hare was awarded the prestigious "Seniors of Significance" Award at OSU on Monday November 21, 2016 at a ceremony at the OSU Conoco-Phillips Alumni Center. She was one of 43 students receiving the award. Drs. Tom Kuzmic and Gail Wilson nominated Anna and they along with Jim Ansley had the opportunity to sit with Anna and her parents and brother at the dinner ceremony.

Anna was also featured in our 2016 NREM course option slick sheet:

December 2016

Fall Graduation

Mikhaila Hobbs graced our NREM representation at Fall OSU graduation with the following very "NREM" graduation cap (although I would have some questions about carrying capacity!!)

I caught a few of the graduates and NREM faculty in the reception at NRC before the ceremony. From left to right are Corbin Wilkins, Andie Ford, Evi Rader, Shelby Robinette, Dr. Karen Hickman, and Mikhaila Hobbs.
---Jim Ansley

December 2016

Chip Leslie Retirement

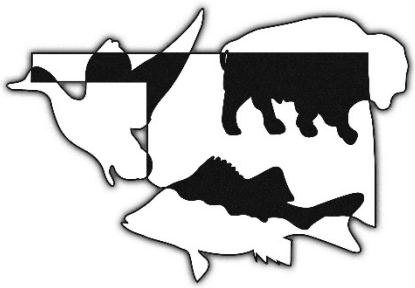
Long time OCFWRU (Coop Unit) Leader David "Chip" Leslie retired in December, 2016. A retirement reception was held for Chip at Zannotti's Wine bar in Stillwater the evening of January 18, 2017. Chip was the Unit Leader from 1989 to 2016 (27 years!!), and was Assistant Unit Leader from 1985 to 1989. He is well-recognized for his mammal research, including work on elk, bighorn sheep, and rodents. We have enjoyed the relationship between NREM and the Coop Unit and wish Chip and his family all the best!!

From left to right, Chip's wife Mary, Chip, and Coop Unit members, Dr. Shannon Brewer, Dr. Jim Long, Cheryl McKnight and Renee Flasch.

Chip's cake featuring some of the wildlife species he has studied.

Jim Long presenting Chip with a wooden plaque that was designed after the OCFWRU logo shown below.

Dr. Jim Long toasting Chip.



NREM Publications

Extension fact sheets and refereed journal articles listed in the next sections are from one year earlier (2015) as there is a bit of a delay in getting all of the current year's publications organized by the January issue date of the newsletter. NREM faculty names are in bold. Asterisk after lead author indicates a graduate student or post-doctorate advised by NREM faculty. If you would like a pdf copy of any of these, the Extension Fact Sheets are available on our web site http://nrem.okstate.edu or the OSU web site OSU Extension web site http://pods.dasnr.okstate.edu/docushare/dsweb/HomePage. To get a pdf of any of the journal publications, please contact one of the faculty authors in bold. Faculty names and email addresses are listed at the end of this newsletter.

NREM Extension Fact Sheets - 2015

Beem, M. 2015. Are Herbicides Safe to Use in My Pond? Fact Sheet NREM-101, Oklahoma Cooperative Extension Service, Oklahoma State University, Stillwater, OK.

Beem, M. 2015. Pond Plants: Weeds or Beneficial? Fact Sheet NREM-9211, Oklahoma Cooperative Extension Service, Oklahoma State University, Stillwater, OK.

Beem, M. 2015. Keep Your Pond in Good Condition. Fact Sheet NREM-9212, Oklahoma Cooperative Extension Service, Oklahoma State University, Stillwater, OK.

Dale, L.L., **T.J. O'Connell**, and **R.D. Elmore**. 2015. Aflatoxins in Wildlife Feed: Know How to Protect Wildlife. Fact Sheet NREM-9021, Oklahoma Cooperative Extension Service, Oklahoma State University, Stillwater, OK.

Elmore, R.D., **K.H. Hickman**, and K. Holmes. 2015. Problem Horticultural Plants. Fact Sheet NREM-2895, Oklahoma Cooperative Extension Service, Oklahoma State University, Stillwater, OK.

Jacques, M., K. McBee, and **R.D. Elmore**. 2015. Determining Sex and Reproductive Status of Rodents. Fact Sheet NREM-2896, Oklahoma Cooperative Extension Service, Oklahoma State University, Stillwater, OK.

Jacques, M., K. McBee, and **R.D. Elmore**. 2015. Managing for Small Mammal Diversity. Fact Sheet NREM-2897, Oklahoma Cooperative Extension Service, Oklahoma State University, Stillwater, OK.

Weir, J.R., R.L. Stevens, and **T.G. Bidwell**. 2015. Prescribed Burn Associations. Fact Sheet NREM-2880, Oklahoma Cooperative Extension Service, Oklahoma State University, Stillwater, OK.

Weir, J.R., and R.S. Coffey. 2015. App: RxBurnTracker. Fact Sheet NREM-2898, Oklahoma Cooperative Extension Service, Oklahoma State University, Stillwater, OK.

DEPARTMENT OF
Natural Resource
Ecology & Management

NREM Refereed Journal Publications - 2015

Albanese, G.*, and **C.A. Davis**. 2015. Characteristics within and around stopover wetlands used by migratory shorebirds: Is the neighborhood important? Condor 117: 328-340.

Allred, B.W., W.K. Smith, D. Twidwell, J.H. Haggerty, S.W. Running, D.E. Naugle, and **S.D. Fuhlendorf**. 2015. Ecosystem services lost to oil and gas in North America. Science 348 (6233): 401-402.

Andersson, K., **C.A. Davis**, G. Harris, and D.A. Haukos. 2015. An assessment of nonbreeding waterfowl surveys on National Wildlife Refuges in

the Central Flyway. Wildlife Society Bulletin 39: 79-86.

Atuo, F., **T. J. O'Connell**, and P.U. Abanyan. 2015. An assessment of socioeconomic drivers of avian body parts trade in West African rainforests. Biological Conservation 191: 614–622.

Baskaran, M., R. Hashim, O. Sulaiman, **S. Hiziroglu,** M. Sato, and T. Sugimoto. 2015. Optimization of press temperature and time for binderless particleboard manufactured from oil palm trunk biomass at different thickness levels. Material Today Communications 3: 87-95.

Bendixsen, D.P.*, **Hallgren, S.W**., and Frazier, A.E. 2015. Stress factors associated with forest decline in xeric oak forests of south-central United States. Forest Ecology and Management 347: 40-48.

Beston, J.A., J.E. Diffendorfer, and **S.R. Loss**. 2015. Insufficient sampling to identify species affected e collisions. Journal of Wildlife Management 79: 513-517.

Bried, J.T.*, N.E. McIntyre, A.R. Dzialowski, and **C.A. Davis**. 2015. Resident-immigrant dichotomy matters for classifying wetland site groups and metacommunities. Freshwater Biology 60: 2248-2260.

Carroll, J.M.*, **C.A. Davis**, **R.D. Elmore, S.D. Fuhlendorf**, and E.T. Thacker. 2015. Thermal patterns constrain diurnal behavior of a ground-dwelling bird. Ecosphere 6 (11): 222. http://dx.doi.org/10.1890/ES15-00163.1.

Carroll, J.M.*, **C.A. Davis**, **R.D. Elmore**, and **S.D. Fuhlendorf**. 2015. A ground-nesting galliform's response to thermal heterogeneity: Implications for ground-dwelling birds. PloS One 10 (11). DOI:10.1371/journal.pone.0143676, November 30, 2015.

Cartabiano, E.C., D.R. Stewart, and **J.M. Long**. 2015. Effect of bait and gear type on turtle bycatch and Channel Catfish population estimates in a reservoir. Journal of Freshwater Ecology 30: 407-415.

Chen, S.J., **C.B. Zou**, T. Cao, J. Huang, S. Wu, S.X. Zhang, and C.G. Chen. 2015. Temporal dynamics and vertical attenuation of photosynthetically active radiation (PAR) in secondary *Pinus Tabulaeformis* stands in the Qinling Mountains. Journal of Basic Science and Engineering 23: 1069-1079.

Choowang, R., and **S. Hiziroglu**. 2015. Properties of thermally compressed oil palm wood (*Elaeis guineensis* Jacq.) using hot press process. Journal of Tropical Forest Science 27 (1): 39-36.

Claytor, M., and **K.R. Hickman**. 2015. Kudzu, *Pueraria montana* (Lour.) Merr. Abundance and distribution in Oklahoma. Oklahoma Native Plant Record 15: 96-102.

Cole, E.K., A.M. Foley, J.M. Warren, B.L. Smith, S.R. Dewey, D.G. Brimeyer, **W.S. Fairbanks**, H. Sawyer, and P.C. Cross. 2015. Changing migratory patterns in the Jackson elk herd. Journal of Wildlife Management 79: 877-886.

Crosby, A., **R.D. Elmore**, **D.M. Leslie Jr.**, and **R.E. Will**. 2015. Looking beyond rare species as umbrella species: northern bobwhites (*Colinus virginianus*) and conservation of grassland and shrubland birds. Biological Conservation 186: 233-240.

Dale, J.*, **C.B. Zou**, W.J. Andrews, **J.M. Long**, Y. Liang, and L. Qiao. 2015. Climate, water use, and land surface transformation in an irrigation intensive watershed—Streamflow responses from 1950 through 2010. Agricultural Water Management 160: 144-152.

Danish, M., T. Ahmad., R. Hashim, M.R. Hafiz, A. Ghazali, O. Sulaiman, and **S. Hiziroglu**. 2015. Characterization and adsorption kinetic study of surfactants treated oil palm empty fruit bunches. Desalination and Water Treatment. Taylor and Francis. doi:10.1080/19443994.2015.1028456.

Dilik, T., S. Erdinler, E. Hazir, H. Koc, and **S. Hiziroglu**. 2015. Adhesion strength of wood-based composites coated with cellulosic and polyurethane paints. Advances in Materials Science and Engineering. Article ID 745675 http://dx.doi.org/10.1155/2015/745675.

Dilik, T., and **S. Hiziroglu**. 2015. Some properties of linoleum and wood laminated flooring panels with magnesium substrate. Bioresources 10 (1): 1667-1674.

Dyer, J.J., T.A. Worthington, and **S.K. Brewer**. 2015. Response of narrow-range crayfish to hyporheic water availability and excess sedimentation. Hydrobiologia 747: 147-157.

Foster, A.J., K. Dhakal, V.G. Kakani, **M. Gregory** and J. Mosali. 2015. Fine and coarse scale sampling

of spatial variability within a switchgrass field in Oklahoma. International Journal of Plant and Soil Science 6: 254-265.

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Johnson, N.C., **G.W.T. Wilson**, J.A. Wilson, R.M. Miller, and M. Bowker. 2015. Mycorrhizal phenotypes and the law of the minimum. New Phytologist 205: 1473-1484.

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Krueger, E.S., T.E. Ochsner, **D.M. Engle**, J.D. Carlson, D. Twidwell, and **S.D. Fuhlendorf**. 2015. Soil moisture affects growing-season wildfire size in the Southern Great Plains. Soil Science Society of America Journal 79 (6): 1567-1576.

Lee, D.N., R.C. Stark, W.L. Puckette, M.J. Hamilton, **D.M. Leslie, Jr.,** and R.A. Van Den Bussche. 2015. Population connectivity of endangered Ozark big-eared bats (*Corynorhinus townsendii ingens*). Journal of Mammalogy 96: 522–530.

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Scasta, J.D.*, **D.M. Engle, S.D. Fuhlendorf**, D.D. Redfearn, and **T.G. Bidwell**. 2015. Meta-analysis of exotic forages as invasive plants in complex multi-functioning landscapes. Invasive Plant Science and Management 8: 292-306.

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We at NREM thank you for taking some time to browse through our Annual Newsletter. You may be interested in attending or having your children attend OSU and earn a degree in one of our NREM graduation options of Fisheries and Aquatic Biology, Forest Ecology and Management, Rangeland Ecology and Management, Wildlife Ecology and Management or Wildlife Biology-Pre-Veterinarian.

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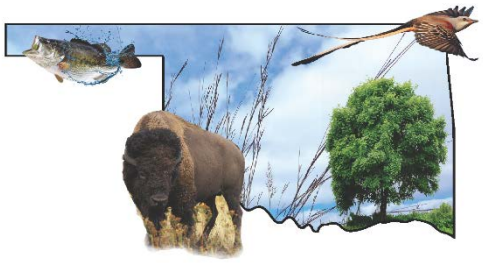
NATURAL RESOURCE ECOLOGY AND MANAGEMENT



“The problem, then, is how to bring about a striving for harmony with land among a people many of whom have forgotten there is any such thing as land, among whom education and culture have become almost synonymous with landlessness. This is the problem of conservation education.”

— **Aldo Leopold**

DEPARTMENT OF
Natural Resource
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Oklahoma Cooperative Fish and Wildlife Research Unit