

Similarities Are Only SKIN-DEEP

Genetic Study Finds Important Differences in Arkansas Deer

Arkansas white-tailed deer – whether they browse along the banks of the Ouachita River in southern Arkansas or drink from Bull Shoals Lake near the Missouri border – belong to one species.

But they don't all carry the same genetic information.

A research study conducted at the Arkansas Conservation and Molecular Ecology Laboratory at the University of Arkansas is delving into genetic differences among individual white-tailed deer and what these variations can tell wildlife biologists who manage chronic wasting disease.

“White-tailed Deer in Arkansas: Genetic Connectivity and Chronic Wasting Disease Susceptibility” is based on DNA samples collected from 1,720 deer across all 75 counties. The effort is a partnership funded with a \$200,000 grant from the Arkansas Game and Fish Commission.

“The study was initiated in response to the discovery of CWD in Arkansas,” said Chris Middaugh, research biologist in the AGFC’s Research, Evaluation and Compliance Division. “We began this study with the intent to learn how to proactively manage CWD in the state. This study has accomplished that and more. We will be able to use this research to benefit our disease management, as well as general management of white-tailed deer across the state.”

Marlis Douglas, Bruker Professor in Life Sciences at the UA’s department of biological sciences, is one of the study’s authors, along with Michael E. Douglas, the department’s 21st Century Chair in Global Change Biology, and graduate students Tyler Chafin, Bradley Martin and Zachery Zbinden. She used a simple analogy as a pretext to what the study involves, and how it can help biologists, during a presentation at the UA’s Science Engineering Building.

“Think of 23andMe,” Douglas said, referring to the popular online ancestry

site for people hoping to piece together their family trees (the company is named for the 23 pairs of chromosomes each human carries). “We’re looking at population connectivity, just like some people might be part Irish and part Italian; their families have intermingled. That gives you an example of what we’re trying to do with all these samples, and what this can tell us.

“This is not black and white; we have to look at the results in a nuanced way.”

In the researchers’ words, “The genetic patterns discovered in our study reflect the dispersal of deer through the diverse and complex environments of the state, and help make predictions about the potential spread of CWD from the



current management zone, but also provide a framework for the adaptive management of both deer and CWD in Arkansas.”

Among other findings, the study reveals the discovery of eight subpopulations of deer across the state, and offers a view of the distribution and frequency of particular genes that can determine an animal’s susceptibility to CWD.

CWD’s rise in Arkansas has been covered extensively in *Arkansas Wildlife*, and its history helps make sense of the study’s results. The disease was discovered among captive mule deer in Colorado in 1967, and was first found in Arkansas in an elk and a deer in 2016 in Newton County. The AGFC has established a 19-county CWD management zone that surrounds 600 cases of CWD-infected deer and 19 infected elk (as of Sept. 15) in northwestern Arkansas, where many samples for this study were collected. Special hunting regulations in the zone help biologists monitor and manage the disease.

CWD is caused by a misfolding in a protein called a prion, which takes its genetic cues from the prion protein gene. Other studies have found a link between certain variants in the prion protein gene and an animal’s susceptibility to

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CWD. That sounds complicated but it means that cervids (deer, elk, caribou and moose) that carry some particular gene variants may be less likely to test positive for CWD, and may survive longer if they contract the disease.

On the surface, this finding could be a sign of hope in fighting CWD, but it also could mean that animals that carry these gene variants survive longer if they’re infected and spread more prions across a wider area than infected animals without the same genetic variation.

“There’s also evidence that these genetic variations at the prion protein gene can influence changes in the infectious prion that is shed, and that could have other negative consequences,” Jenn Ballard, AGFC state wildlife veterinarian, said.

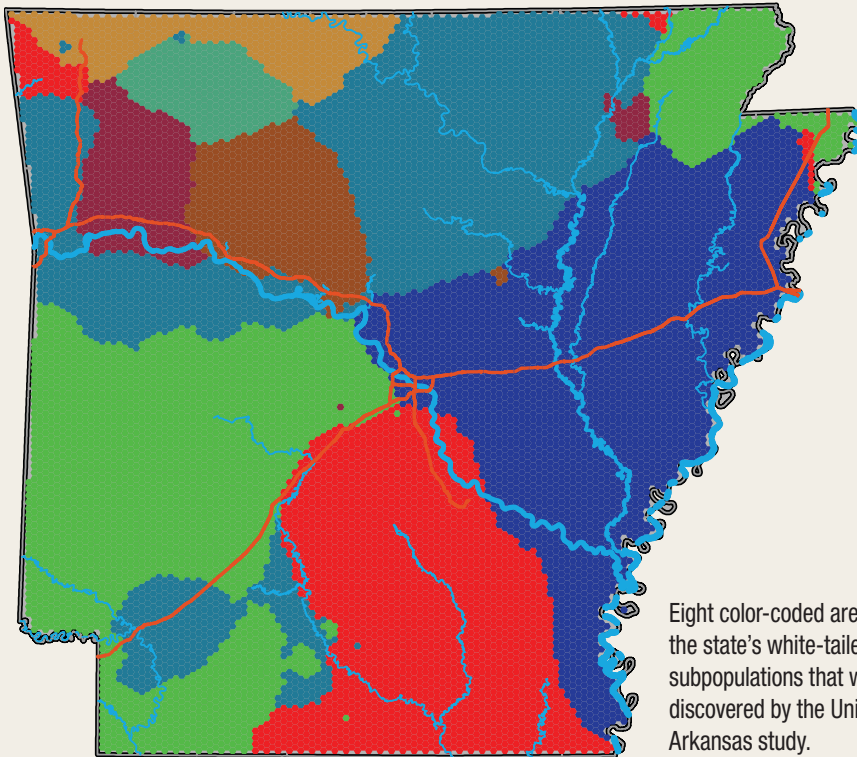
The discovery of eight subpopulations of deer across the state is interesting because of their backgrounds and how they’ve mingled. The boundaries between the subpopulations are not hard and fast because of natural interbreeding and movement among subpopulations. If the study continued and more samples were collected, the boundaries would become better defined.

“Those samples were extrapolated to create these maps of the populations,” Douglas said. She pointed out that a map of the genetic populations was “oversimplified,” although it’s clear that patterns exist.

Key Study Findings

- Arkansas is home to at least eight subpopulations of white-tailed deer.
- DNA revealed subpopulations that were moved from other states and stocked from within the state more than 75 years ago.
- Deer move more and less freely in different regions, depending on various environmental factors.
- The Arkansas River is a major barrier to deer dispersal.
- One variant of the prion protein gene, dubbed haplotype C, is associated with reduced susceptibility to CWD and is more common in older individuals in the CWD focal area, which indicates increased survival for those with the gene.
- Four previously undocumented haplotypes were found in Arkansas.

Arkansas Deer Subpopulations



Eight color-coded areas mark the state's white-tailed deer subpopulations that were discovered by the University of Arkansas study.

Echoes Remain

Douglas says the study shows that bucks move into new territory, and she was “excited” that the samples revealed “some natural, historic connectivity.”

For example, deer that carry genetic markers of Wisconsin whitetails show up in south-central Arkansas, where they were moved from America’s Dairyland in 1942-44. Some deer in northeastern Arkansas have markers that match deer from Howard County Game Refuge, which opened in 1930 in southwestern Arkansas.

“We find these relic populations where (sample) densities are highest,” Douglas said. “We may be missing out on relic populations in areas with lower sample size.”


The study also presents questions about the ranges of the subpopulations. Are deer dissuaded from moving to new habitat by streams, weather, terrain, highways, vegetation or other obstacles?

“There are places where deer don’t disperse in the Ozarks and we’re not sure why in some of those areas,” Zbinden said. “We don’t know if the boundaries follow ridgelines; maybe (deer) tend to stay in valleys. It would be interesting to follow up on that.”

The study’s objectives underline the importance of learning more about why, where and how deer populations move: “Understanding landscape characteristics conducive to deer dispersal can help management to focus on those areas where CWD might more rapidly spread into deer herds that are currently CWD-free.”

Researchers used a cutting-edge method called SNP genotyping to analyze samples.

“This method is more effective than traditional methods (used over the last 20-plus years in wildlife management) for detecting subtle population structure, and thus herd connectivity, because it allows hundreds of samples to be screened across thousands of genetic markers,” researchers wrote. “Thus, it is both efficient and cost-effective.”

The research team is scheduled to present its findings Wednesday, Feb. 19, during the AGFC’s monthly meetings in Little Rock. 

—Jeff Williams

Deer Tally Tops 200,000 Again

Hunters in Arkansas checked 210,065 white-tailed deer during the 2018-19 season. It was the fourth-highest total on record and the seventh-consecutive season that the total has topped 200,000.

Arkansas deer hunting records began in 1938 when 203 were reported killed across the state. The record season was 2012-13 with 213,487.

Familiar counties topped the 2018-19 totals. Union was first with 6,385, Clark second at 5,704, and Washington third at 5,623.

As always, the modern gun method led archery, crossbow and muzzleloader totals. Modern gun hunters harvested 156,843 deer, about 75 percent of the total harvest. Muzzleloaders hunters bagged 24,688 deer (12 percent), archers took 17,859 deer (8.5 percent) and crossbow hunters totaled 10,675 (about 5 percent).

Deer zone 12 in south-central Arkansas led all zones with 64,070 deer checked. Hunters in zone 3 (north-central Arkansas) checked 18,735 deer and zone 13 (along the Interstate 30 corridor) totaled 16,487 for second and third on the list.

Bucks made up 53 percent of the harvest; does accounted for 47 percent.

Eight cities in the state held urban archery hunts that accounted for 823 deer. Hot Springs Village reported 276 deer taken. Fairfield Bay was second at 178, followed by Cherokee Village (102), Horseshoe Bend (82), Bull Shoals (68), Russellville (52), Heber Springs (33) and Lakeview (32).