REPORT OF DEER POPULATION SURVEY, 2016

PERFORMANCE REPORT
STATEWIDE WILDLIFE RESEARCH AND SURVEYS

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DEER POPULATION SURVEY USING DISTANCE SAMPLING TECHNIQUES, 2016.

OBJECTIVE:

The deer population monitoring using distance sampling techniques was initiated in 2002 to provide population estimates and trend information. This report summarizes the last 11 years of that survey.

METHODS:

Since 2003 the Kansas Department of Wildlife, Parks and Tourism (KDWPT) has estimated deer abundance using Distance Sampling procedures. Dr. Clayton Nielson and an assistant from Holtera Wildlife Management trained 22 employees in 2002 on Distance Sampling procedures using spotlights to survey deer. Equipment and trained personnel were limited during early years of this survey method. The primary purpose of the first year was to identify and correct problems. Data from 2002 are not used in long term trend analysis due to those limitations. After 2002, training has been available in a one-on-one basis for new employees. Since 2008, we have assisted Dr. Robert Hagen's field ecology techniques class at Kansas University. Students are given lecture and lab instructions for Distance Sampling. They also participate in evening spotlight surveys around the KU Field Station. New employees for KDWPT have been invited to obtain training during that class. When new employees have been unable to attend a formal training session they have been given individual training by either a permanent employee with years of survey experience or the deer program coordinator.

Surveys have been conducted using two observers independently operating spotlights from an elevated observation rack in the back of a pickup truck. A survey generally consists of three nights of effort. The design was to have at least two surveys per Deer Management Unit (DMU). One survey was completed to monitor deer populations on private lands while the second survey monitored deer populations on a public hunting area.

The survey period is during October and November, a period of time known to result in the highest observation rates during the year with the least variance (McCullough 1982, Fafarman and DeYoung 1986 and Collier et. al. 2007). Employees have been encouraged to conduct their survey in November after leaf drop and when movements due to rut behavior might increase the likelihood of seeing male deer. Employees have been encouraged to keep conditions similar among years, including the dates when the surveys were conducted. The same survey routes have been run each year when possible. An effort has been made to include the same personnel each year; however, employee turnover has been substantial during recent years.

Generally, three routes or transects in three or more counties of a DMU were searched and combined to constitute a survey on private lands. Routes were spaced from north to south and east to west within the DMU to be spatially representative of the unit. Transect lengths were approximately 20 miles long and almost all occurred along dirt or gravel public roads. The routes were selected to provide samples from representative habitats for the DMU. We attempted to

locate all private lands routes at least 5 miles from a public hunting area. Biologists were also asked to use their knowledge of local conditions and to select transects in areas that did not include either areas known to have an unusually high or low deer populations. Orientation of the private lands routes avoided roads that run parallel to woody riparian vegetation along stream systems.

Routes at public hunting areas were frequently short in length compared to the private lands routes. Unlike the private lands surveys, transects could be located along interior trails not open to public travel. Frequently there were 5-6 short routes on the wildlife area and the same series of routes were surveyed over the course of two or three nights. Multiple night surveys were used in order to obtain a sufficient number of observations of deer that were independent of each other and adequate to calculate a detection function.

A goal for minimum sample sizes has been 60 observations of groups or clusters of deer for each private land and each public land survey in a DMU. A maximum of three nights of effort per survey was set in order to keep workloads acceptable within the other duties of Department personnel. Relatively small sample sizes based on 2 to 4 nights of spotlighting for approximately 2 ½ hours each, starting one hour after sunset provide an adequate index to deer abundance (Winchcombe and Ostfeld 2001).

Increased emphasis was placed on monitoring mule deer in 2016. In addition to the standard routes, 64 new 8-mile survey routes were located in the western 9 DMUs. Survey locations are shown in Table 1. A coordinator was assigned for each survey and given the responsibility to organize personnel to assist with the survey, maintain equipment and transfer data to the big game coordinator. (see Table 2).

Data were initially collected on standard paper forms and transferred to electronic spreadsheet (see Figure 1). In recent years the majority of personnel collected data used either a Trimble unit or an Android smartphone CyberTracker software. The distribution of survey routes sampled with CyberTracker are shown in Figure 2. Details of the survey and locations where observations were taken on deer may also be shown from the CyberTracker data, for example, the route surveyed at Mined Land Wildlife with observation points is shown in Figure 3. Surveys conducted at Norton Wildlife Area (NORR), Cedar Bluff Wildlife Area (CDBR), Webster Wildlife Area (WEBR), Fort Riley (FTRL), Tuttle Creek Wildlife Area (TCRR), The Flint Hills NWR (FHNWR), Pratt Sandhills Wildlife Area (PRSH) and Clinton Wildlife Area (CLTR) were recorded on paper and therefore do not show on the statewide map produced from the CyberTracker data. For unknown reasons there were no GPS data for the routes conducted at Milford Wildlife Area (MILR), and they therefore do not show on the map.

Standard summary variables were calculated for each transect and totaled for the whole survey area. Analysis to estimate density was done using Distance 6.2 Release 2 (Laake et. al. 2009). Initially four models were attempted using detection functions, including uniform, half-normal, hazard-rate, and negative exponential models. A cosine series expansion was used with those models. Additional models were attempted after those standard models if sample sizes were sufficient. The model with the lowest AIC value was generally chosen to estimate the density of deer. RESULTS:

Estimates of deer abundance were made for 65 survey areas during the 2016 Distance Sampling Spotlight Survey. The total distance travelled along 297 transects was 2,536.5 miles. The crews spent 323 hours and 50 minutes actively searching for deer. They recorded a total of 6,680 deer in 3,256 groups this year (5,967 white-tailed deer, 259 mule deer and 175 deer where the species could not be distinguished). Table 3 shows the annual summary results of survey efforts and observations from 2006 through 2016. These surveys include observations from many employees and throughout the state. Because of small sample sizes in some surveys some data may indicate relatively large changes from one year to next at the level of a survey area. However, the overall statewide results appears stable through the last 11 year period.

Spotlight surveys provide a biased estimate of sex ratios in the populations. Males and fawns are generally either underrepresented or misidentified as adult females (McCullough 1982). Instructions for the Kansas Distance Sampling Spotlight Survey emphasizes the need for care when classifying deer and to use the unknown age, sex, and species classifications to minimize classification errors (i.e., when in doubt, classify as an unknown). It is assumed that our survey results are probably a conservative estimate of the true value for number of mule deer encountered. Age and sex biases have not been evaluated, however, they are provided in this report primarily for trend purposes. Statewide estimates of bucks per 100 adult does averaged 33.4 during the 2016 surveys. The value has ranged from 30.5 in 2014 to 37.4 in 2009. Trends in fawns per 100 adult does appear to decline slightly over the last 11 years, ranging from 70.2 in 2009 to 47.9 in 2016. Yearling bucks have made up about 31.5% of the antlered deer classified during the last 11 year survey period. There has been a slight decline in the percent of yearling bucks among the antlered deer during the last 11 years.

Summary details from each transect completed during 2015 were included in an appendix to this report; however, similar data from the 2016 survey may be obtain upon request. It includes names of people conducting the surveys, dates and times when observations were made, number of groups of deer seen and classification of the deer by age, sex and species, length of the transects and summaries of deer seen per mile average speed of travel, bucks per 100 adult does and fawns per 100 adult does.

Concern by deer hunters and KDWPT field employees about declines in the number of mule deer and decreases in their distribution has resulted in increased surveillance for this species. During the 2016 Spotlight/Distance Survey there were 64 additional survey routes initiated in the nine western DMUs. Only 63 of those routes were completed this year. The new survey routes were established as 8-mile routes instead of the traditional 20+ mile routes typically conducted to monitor deer on private land. Shorter transects provide greater degree of resolution; however, shorter routes generally take more time per survey mile to conduct due to an increase in travel time between transects.

Analysis of the data for traditional routes, new routes and the combined routes was done at both a DMU scale and on the east and west zone scale which is currently being used in permit allocations. Density estimates from the new survey routes were compared to density estimates of the traditional survey routes, see Table 4. The estimates from the new routes were lower at 6 of the DMUs but higher at 3 of them.

All of the traditional transect routes in the 4 DMU in the west zone (i.e., DMU 1, 2, 17, & 18) were combined and compared with the corresponding new transect routes and analyzed using Distance. Similarly, the traditional transect routes in the 5 DMU in the east zone (i.e., DMU 3, 4, 5, 7, & 16) were combined and compared with the corresponding new transect routes. The results are shown in Figure 3.

The mean value for deer densities in these zones were not significantly different between the new and old routes. By combining both the old and new routes we can estimate deer density with greater precision.

Trends in the abundance of deer in private lands areas of each DMU are shown in Figure 4. Effects of a severe mortality event in eastern and northeastern portions of the state appear in the charts for DMU 8, 9, 10 and 11N in 2012. Similarly, declines in the southwest portion of the state (DMU 16, 17 and 18) show up in the charts for those areas in 2011 and 2012 following drought years. Lack of fawn recruitment appears to be a driving force for the population decline in the southwest. During 2009 and 2010 the fawns per 100 adult does in DMU 16, 17 and 18 averaged 90.4 whereas it dropped to 35.8 fawns per 100 adult does during the years 2011 through 2014. Fawn recruitment in those units increased to 56.9 fawns per 100 adult does during the 2015 surveys in the southwest units and it was 64.2% for the combined old and new survey routes in DMU 16, 17 & 18 in 2016.

The spatial pattern of deer density among the 19 Deer Management Units are presented in Figure 5. That figure uses average deer densities during the last 11 years from the private lands surveys. Highest deer densities have occurred in the Chautauqua Hills and Arkansas Lowland portions of the state (DMU 5, 12, 13, 15) while the lowest densities occur in the Southern High Plains (DMU 2, 17 and 18).

Using the estimated density of a DMU and the size of the DMU we made an estimate of the number of deer in the state, see Figure 6. The estimated fall population prior to the firearms hunting season has averaged 635,000 and varied from 531,500 to 745,000 during that 11 year period.

We also analyzed the spotlight distance survey data to estimate the abundance and trends of mule deer populations. We combined all transects in the west mule deer zone, (i.e., DMU 1, 2, 17 and 18) and all transects in the east zone, (i.e., DMU 3, 4, 5, 7, and 16) to obtain estimates in those zones. Those estimates are conservative for mule deer as they exclude all deer observations where the species was classified as unknown. Undoubtedly some of those observations were of mule deer. We also included all transects from the wildlife areas and special survey area in the zones. Typically the mule deer population appears lower on public hunting areas than on private land and by including those transects we included more miles of observation where few or no mule deer were detected. The estimated mule deer population has averaged 50,000 over the last 11 years. The trend in the mule deer population is shown in figure 7.

Trends in the abundance of deer at wildlife areas are shown in Figure 8. Typically open public access at wildlife areas results in high hunter density and competition for hunting space. Hunters using only wildlife areas have lower hunter success rates than hunters using only private lands. Concern has been expressed that the heavy hunting pressure would result in a deterioration of the deer herd using the public lands. The distance sampling / spotlight survey provides a means to monitor the deer herd using public lands independent from hunter harvest reports. The survey design allows a comparison between these land types. In 2016 deer surveys were completed at 24 wildlife areas. They had an average deer density of 21.6 deer per square mile with age sex ratios of 36.5 bucks per 100 adult does and 57.2 fawns per adult does. The corresponding values from 20 surveys done on private land produced an estimated density at 8.3 deer per square mile with age and sex ratios of 36.0 bucks per 100 does and 52.4 fawns per 100 adult does. There was no apparent difference in the prevalence of yearling bucks among the antlered deer on private lands, (27.1%) compared to their prevalence at open public access wildlife areas (31.7%). While hunting pressure may be a factor reducing hunter success and satisfaction at wildlife areas, it appears that the combination of habitat management and local refuges on public land allows deer populations to prosper similar to the population on private lands.

MANAGEMENT IMPLICATIONS:

The Spotlight / Distance Survey of Deer is providing a consistent monitoring process for deer populations at a DMU scale with insight into local populations on selected wildlife areas. It is independent of hunter effort and allows deer managers to detect trends and evaluate deer populations in relation to harvest activities, habitat, and other environmental factors.

This survey is not designed to tell landowners and private land managers about deer populations on their specific hunting or area of concern, especially if those areas are either small acreages or intensively managed. Landowners and land managers are encouraged to consult with the local District Wildlife Biologist for site specific management recommendations.

Over the last three centuries the deer population in Kansas has undergone dramatic fluctuations from abundant to near extinction and back again to levels some have called “overabundance”. During the last decade the number of deer in Kansas has remained relatively stable. Continued monitoring of the deer population should be continued.

Table 1. Deer Management Units, Wildlife Areas and special areas where density estimates were obtained from Spotlight / Distance Deer Surveys conducted in Kansas, 2016.

	Private Lands				
DMU	Standard Routes	New 8-Mile Routes: (n)	Combined Routes Analysis	Public Lands Surveys	Special Area Survey Routes
1	Yes	Yes (11)	Yes	NORR	CWD
2	Yes	Yes (7)	Yes	CDBR	
3	Yes	Yes (8)	Yes	WEBR	
4	Yes	Yes (4)	Yes	SMWA	
5	Yes	Yes (4)	Yes	CHBW	
6	Yes			MARR/MPWA	
7	Yes	Yes (3)	Yes	GELR	
				LOVR	
				WILR	
8	Yes			MILR	Ft Riley
9	Yes			TCRR	
				JFWA	
10	Yes			PERR	KU
11N	Yes			HILR	
11C	Yes			n/a	
11S	Yes			MLWA	
				GOWA	
12	Yes			EKCR	
12				FLRR	
13	Yes			KAWA	
14	Yes			MELR	FHNWR
15	Yes			n/a	
16	Yes	Yes (8)	Yes	PRSH	
17	Yes	Yes (11)	Yes	n/a	
18	Yes	Yes (7)	Yes	CMNG	
19	No			CLTR	SMCP

Table 2. Coordinators of Spotlight / Distance Deer Surveys for 2016.

Route Coordinator	County or Wildlife Area	DMU	Public, Private or Special	Email Address
Wes Sowards	RATH/GH/CNSH	1	Private	wes.sowards@ksoutdoors.com,
Luke Winge	NORR	1	Public	luke.winge@ksoutdoors.com
Lloyd Fox	DC/RA	1	CWD	lloyd.fox@ksoutdoors.com,
Lloyd Fox	WA/LG/GO	2	Private	lloyd.fox@ksoutdoors.com,
Lloyd Fox	SVR	2	Special	lloyd.fox@ksoutdoors.com,
Kent Hensley	CDBR	2	Public	kent.hensley@ksoutdoors.com,
Eric Wiens	PL/OB/RO	3	Private	eric.wiens@ksoutdoors.com
Michael Zajic	WEBR	3	Public	michael.zajic@ksoutdoors.com,
James Svaty	RS/RSEL/SA/EW	4	Private	james.svaty@ksoutdoors.com
Scott Thomasson	SMWA	4	Public	scott.thomasson@ksoutdoors.com,
Charlie Swank	BTSF/RHPN	5	Private	charlie.swank@ksoutdoors.com,
Karl Grover	CHBW	5	Public	karl.grover@ksoutdoors.com,
Lloyd Fox	QNWR	5	Public	lloyd.fox@ksoutdoors.com,
Jeff Rue	HVMP/MN/MNMP/M	6	Private	jeff.rue@ksoutdoors.com,
Jason Black	MPWA/MARR	6	Public	jason.black@ksoutdoors.com
Luke Kramer	SM/MC/JW	7	Private	Lucas.Kramer@ksoutdoors.com,
Chris Lecuyer	GELR	7	Public	chris.lecuyer@ksoutdoors.com,
Scott Thomasson	WILR	7	Public	scott.thomasson@ksoutdoors.com,
Rob Unruh	LOVR	7	Public	rob.unruh@ksoutdoors.com
Clint Thornton	DK/CY/WS	8	Private	clint.thornton@ksoutdoors.com,
Kristin Kloft	MILR	8	Public	kristin.kloft@ksoutdoors.com,
Clint Thornton	RL (KONZA)	8	Special	clint.thornton@ksoutdoors.com,
Corey Alderson	MSPT/PT	9	Private	corey.alderson@ksoutdoors.com,
Nathan Henry	TCRR	9	Public	nathan.henry@ksoutdoors.com
Tyler Warner	BR/AT/JA	10	Private	tyler.warner@ksoutdoors.com,
Andrew Page	PERR	10	Public	andrew.page@ksoutdoors.com
Lloyd Fox	DG/JF/LV (KU)	10	Special	lloyd.fox@ksoutdoors.com
Andy Friesen	MI	11N	Private	andy.friesen@ksoutdoors.com,
Eric Kilburg	HILR	11N	Public	Eric.Kilburg@ksoutdoors.com,
Justin Harbit	LN/BB	11C	Private	justin.harbit@ksoutdoors.com
Tim Menard	MDCNWR	11C	Public	tim_menard@fws.gov

Table 2. Coordinators of Spotlight / Distance Deer Survey for 2016. (Continued)

Robert Riggin	MLWA	11S	Public	rob.riggin@ksoutdoors.com,
Robert Riggin	GOWA	11S	Special	rob.riggin@ksoutdoors.com,
Vickie Cikanek	WOWL/CQ	12	Private	vickie.cikanek@ksoutdoors.com,
Darin Porter	ELCR	12	Public	darin.porter@ksoutdoors.com,
Benjamin Stultz	FLRR	12	Public	benjamin.stultz@ksoutdoors.com
Jeff Rue	SU/CLSU/CL	13	Private	jeff.rue@ksoutdoors.com,
Kurt Grimm	KAWR	13	Public	kurt.grimm@ksoutdoors.com,
Lloyd Fox	LY/MR/GW	14	Private	lloyd.fox@ksoutdoors.com
Brad Niemann	MELR	14	Public	brad.niemann@ksoutdoors.com
Tim Menard	FHNWR	14	Public	tim_menard@fws.gov
Steve Adams	KM/RN	15	Private	steven.adams@ksoutdoors.com,
Troy Smith	BWWA/CHNR	15	Public	troy.smith@ksoutdoors.com,
Lloyd Fox	CACM/BAPR	16	Private	lloyd.fox@ksoutdoors.com
Todd Gatton	PRSH	16	Public	todd.gatton@ksoutdoors.com,
Kurtis Meier	KE/FO/GYFI	17	CREP	kurtis.meier@ksoutdoors.com,
Tom Norman	SSWA	17	Public	tom.norman@ksoutdoors.com,
Kraig Schultz	SV/SWHS/ME	18	Private	kraig.schultz@ksoutdoors.com,
Kraig Schultz	CNGL	18	Public	kraig.schultz@ksoutdoors.com,
Justin Hamilton	CLTR	19	Public	justin.hamilton@ksoutdoors.com
Lloyd Fox	SMP	19	Special	lloyd.fox@ksoutdoors.com

New Coordinator in 2016

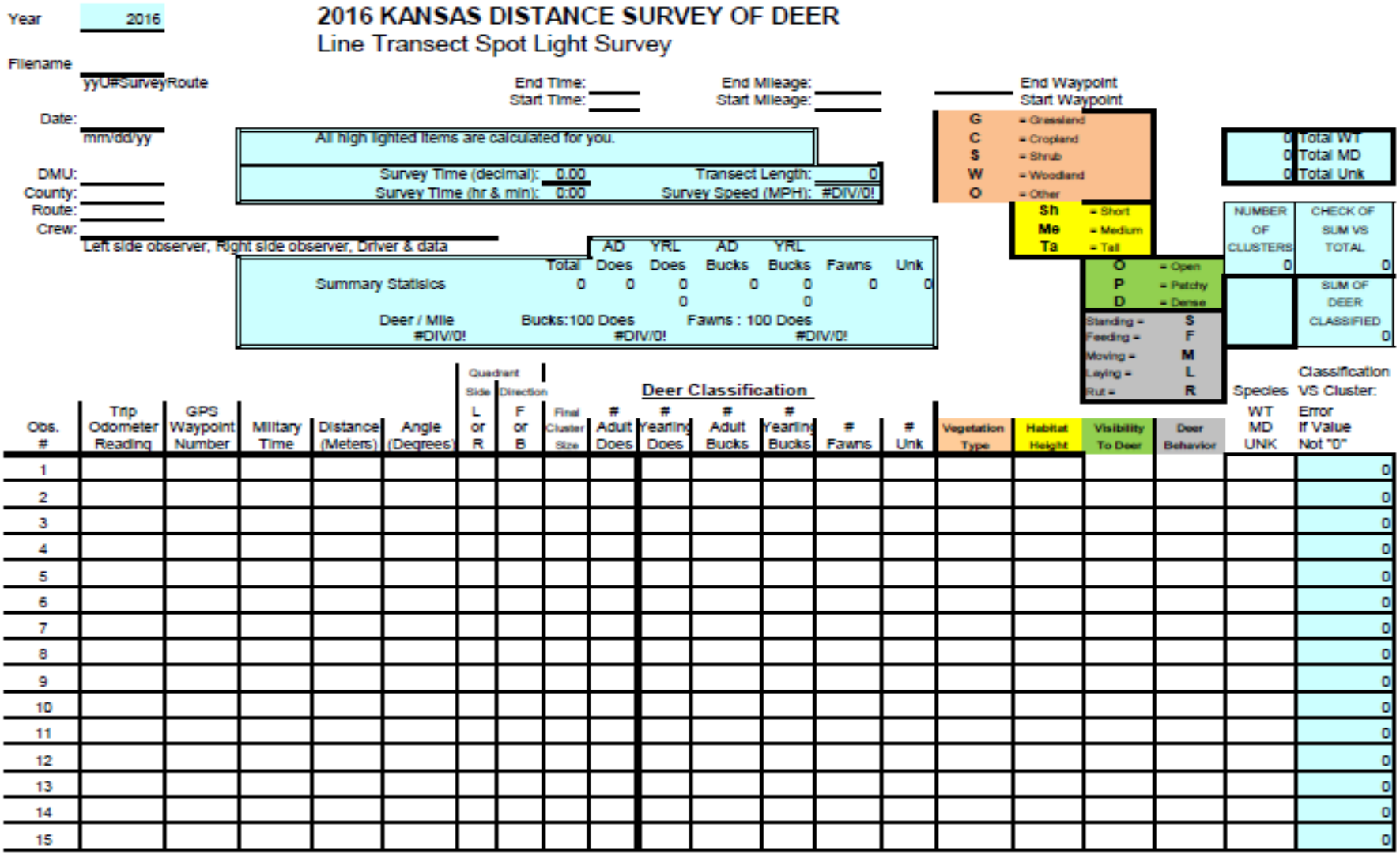
Table 3. Annual summaries of distance sampling / spotlight surveys conducted in Kansas from 2006 through 2016.

Year	Number of Clusters	Total Deer	Number Adult Doe	Number Yearling Doe	Number Adult Buck	Number Yearling Buck	Number Fawn	Age & Sex Unknown	Total WT Deer	Total MD Deer	Total UNK Deer	Transect Length	Survey Time (decimal)	Survey Speed MPH	Deer Per Mile	BUCKS PER 100 DOES	FAWNS PER 100 DOES
2006	1857	3867	1486	142	299	224	1067	649	3317	216	259	1554.7	203.53	7.64	2.49	32.13	65.54
2007	2067	4049	1644	82	393	204	1193	533	3650	264	31	1645.7	282.71	5.82	2.46	34.59	69.12
2008	2620	5479	1974	171	533	230	1463	1108	4548	279	107	1851.2	238.88	7.75	2.96	35.57	68.21
2009	2844	5823	2127	114	555	282	1572	1173	4930	319	219	1889	258.12	7.32	3.08	37.35	70.15
2010	3554	7434	2866	188	675	330	1964	1410	6061	284	420	2090.18	320.96	6.51	3.56	32.91	64.31
2011	3419	7187	2823	228	671	309	1735	1421	5910	233	210	1997.85	287.25	6.96	3.60	32.12	56.87
2012	2904	6625	2797	193	638	311	1562	1120	5523	183	129	1664.9	229.34	7.26	3.98	31.74	52.24
2013	2842	6588	2681	251	695	254	1623	1084	5767	320	185	1976.8	279.63	7.07	3.33	32.37	55.35
2014	2869	6308	2527	146	591	225	1462	1357	5404	197	306	2029.2	261.45	7.76	3.11	30.53	54.70
2015	2872	6289	2565	130	623	275	1504	1292	5970	236	182	2032.6	278.78	7.29	3.14	33.32	56.81
2016	3256	6680	2710	249	702	285	1416	1319	5967	259	175	2536.5	323.84	7.83	2.63	33.36	47.85
Total	31104	66329	26200	1894	6375	2929	16561	12466	57047	2790	2223	21268.63	2964.49	7.17			
Average	2827.6	6029.9	2381.8	172.2	579.5	266.3	1505.5	1133.3	5186.1	253.6	202.1	1933.5	269.50	7.17	3.12	33.12	58.95

Table 4. Deer densities and percent of the observations classified as mule deer from the traditional survey routes, new 8-mile survey routes and a combination of those routes in the west and east mule deer zones of Kansas, 2016.

	Traditional Routes					New Routes				Combined Routes			
	Estimated Density	Lower 95%	Upper 95%	Percent Mule Deer 2016	Average %MD Since 2006	Estimated Density	Lower 95%	Upper 95%	Percent Mule Deer	Estimated Density	Lower 95%	Upper 95%	Percent Mule Deer
West Zone													
DMU 01	9.6	5.8	15.7	58.3%	62.2%	7.6	4.2	13.7	49.1%	7.7	5.2	11.4	53.3%
DMU 02	2.2	0.8	5.9	28.2%	42.0%	2.5	0.9	7.0	15.0%	2.4	1.2	4.6	21.5%
DUM 17	4.5	1.1	17.8	7.7%	15.3%	1.8	0.9	3.5	44.0%	2.9	1.4	5.7	20.6%
DMU 18	6.2	1.9	20.9	11.1%	27.8%	2.6	0.9	7.0	11.4%	5.2	2.6	10.2	11.2%
All	5.7	3.8	8.5			3.9	2.6	5.9		4.4	3.3	5.8	
Mule Deer										1.5	0.9	2.5	
East Zone													
DMU 03	9.5	6.6	13.7	1.3%	8.6%	8.2	3.2	21.0	2.3%	8.7	5.6	13.7	1.8%
DMU 04	8.5	6.5	11.1	0.0%	0.9%	5.6	3.2	9.6	13.9%	7.7	6.1	9.7	4.0%
DMU 05	8.3	3.5	19.6	0.0%	2.0%	3.7	1.8	7.7	7.3%	6.5	4.1	10.5	1.8%
DMU 07	8.3	6.0	11.6	0.0%	0.9%	3.0	0.6	14.0	0.0%	7.0	4.5	10.9	0.0%
DMU 16	9.6	6.4	14.3	0.0%	0.5%	6.5	3.4	12.2	0.0%	7.7	5.3	11.3	0.0%
All	8.7	7.3	10.3			5.9	4.1	8.6		7.5	6.3	8.9	
Mule Deer										0.1	0.0	0.5	

Figure 1. Standard paper form for the collection of distance sampling data.



Year 2016

2016 KANSAS DISTANCE SURVEY OF DEER
Line Transect Spot Light Survey

Filename
yyU#SurveyRoute

End Time:
Start Time:
End Mileage:
Start Mileage:
End Waypoint
Start Waypoint

Date:
mm/dd/yy

All high lighted items are calculated for you.

Survey Time (decimal): 0.00
Survey Time (hr & min): 0:00
Transect Length: 0
Survey Speed (MPH): #DIV/0!

DMU:
County:
Route:
Crew:
Left side observer, Right side observer, Driver & data

Summary Statistics	Total	AD Does	YRL Does	AD Bucks	YRL Bucks	Fawns	Unk
	0	0	0	0	0	0	0
			0		0		

Deer / Mile #DIV/0! | Bucks:100 Does #DIV/0! | Fawns : 100 Does #DIV/0!

G	= Grassland
C	= Cropland
S	= Shrub
W	= Woodland
O	= Other

Sh	= Short
Me	= Medium
Ta	= Tall

O	= Open
P	= Patchy
D	= Dense

Standing =	S
Feeding =	F
Moving =	M
Laying =	L
Rut =	R

0	Total WT
0	Total MD
0	Total Unk

NUMBER OF CLUSTERS	CHECK OF SUM VS TOTAL
0	0
	SUM OF DEER CLASSIFIED
	0

Obs. #	Trip Odometer Reading	GPS Waypoint Number	Military Time	Distance (Meters)	Angle (Degrees)	Quadrant Side L or R	Quadrant Direction F or B	Final Cluster Size	Deer Classification: # Adult Does	# Yearling Does	# Adult Bucks	# Yearling Bucks	# Fawns	# Unk	Vegetation Type	Habitat Height	Visibility To Deer	Deer Behavior	Species WT MD UNK	Classification VS Cluster: Error If Value Not "0"
1																				0
2																				0
3																				0
4																				0
5																				0
6																				0
7																				0
8																				0
9																				0
10																				0
11																				0
12																				0
13																				0
14																				0
15																				0

Figure 2. Distribution of routes surveyed with Trimble units or smart phones using CyberTracker program during 2016 spotlight surveys for deer in Kansas.

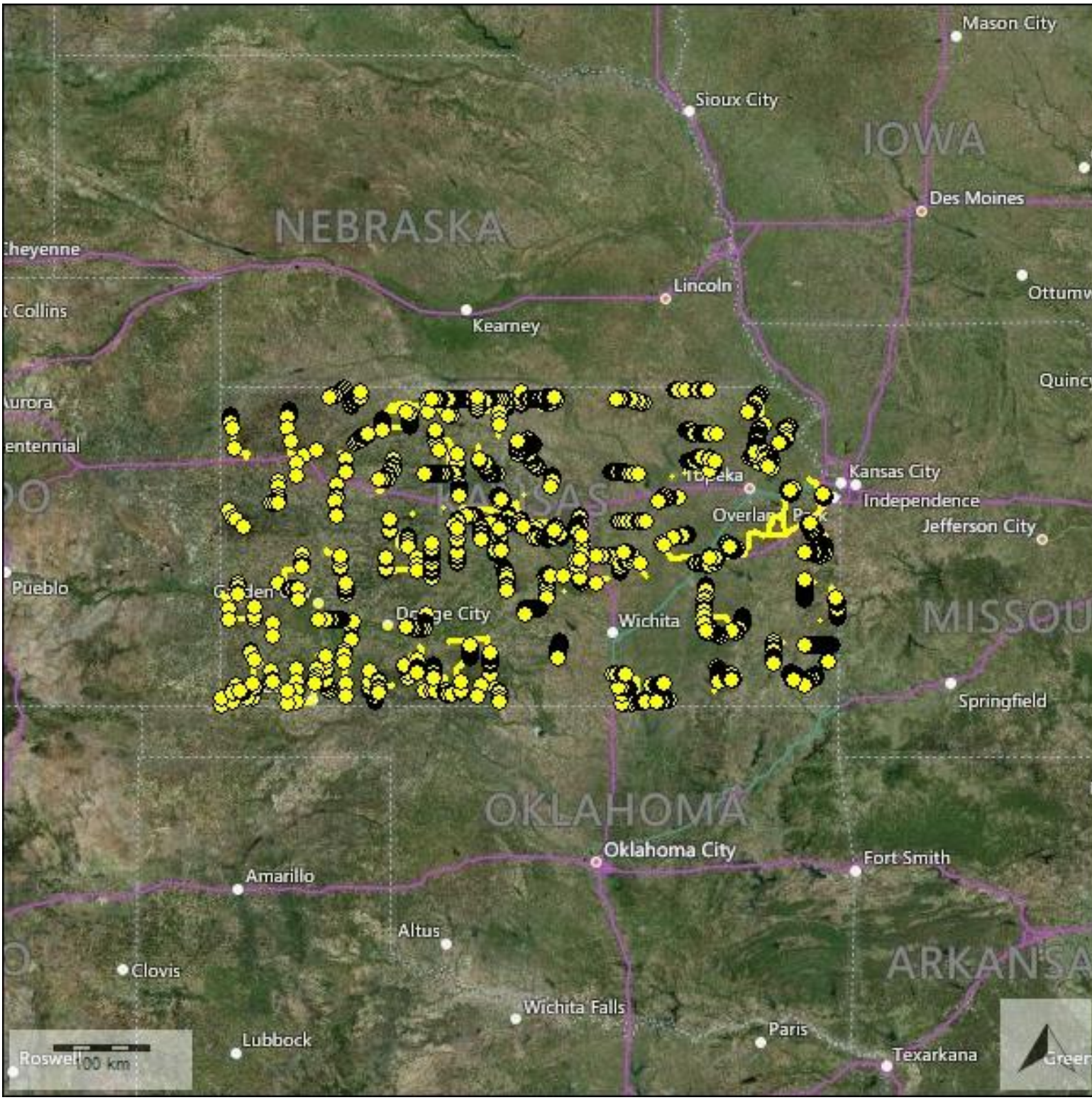


Figure 3. Survey route at Mined Lind Wildlife Area with deer observation points along the transect in 2016.

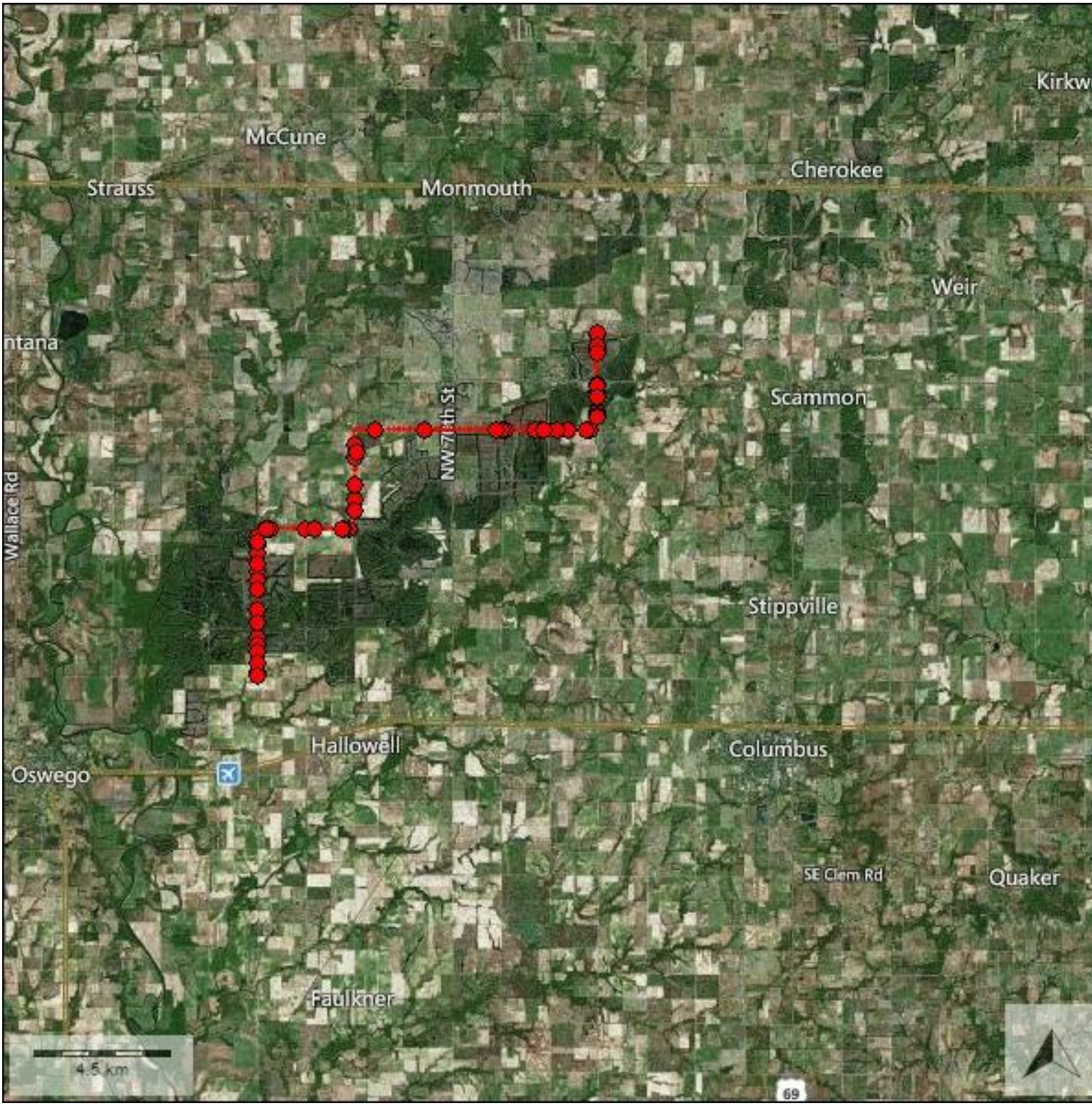
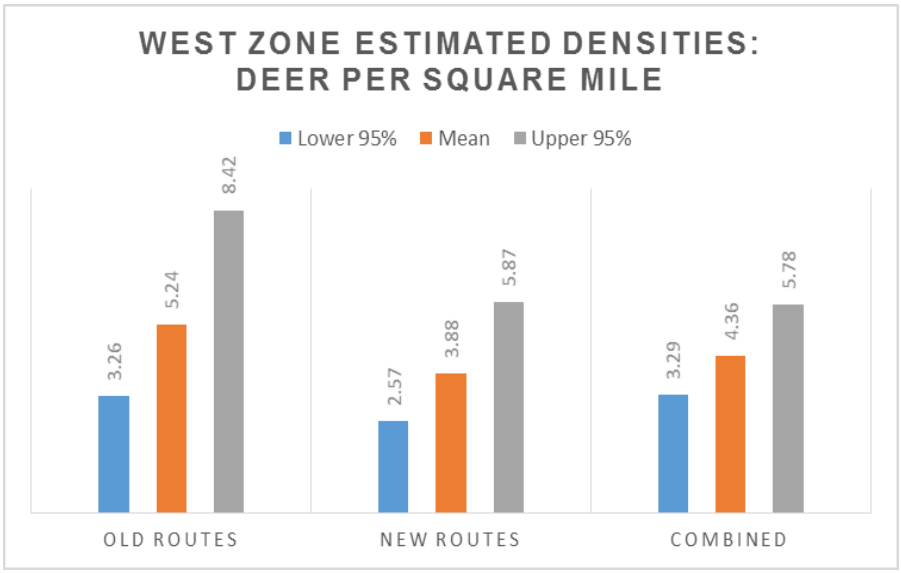


Figure 3. Comparison of deer density estimates and 95% confidence intervals using program Distance 6.2 for traditional versus new transect routes versus the combined transect routes within the west and east mule deer zones of Kansas in 2016.



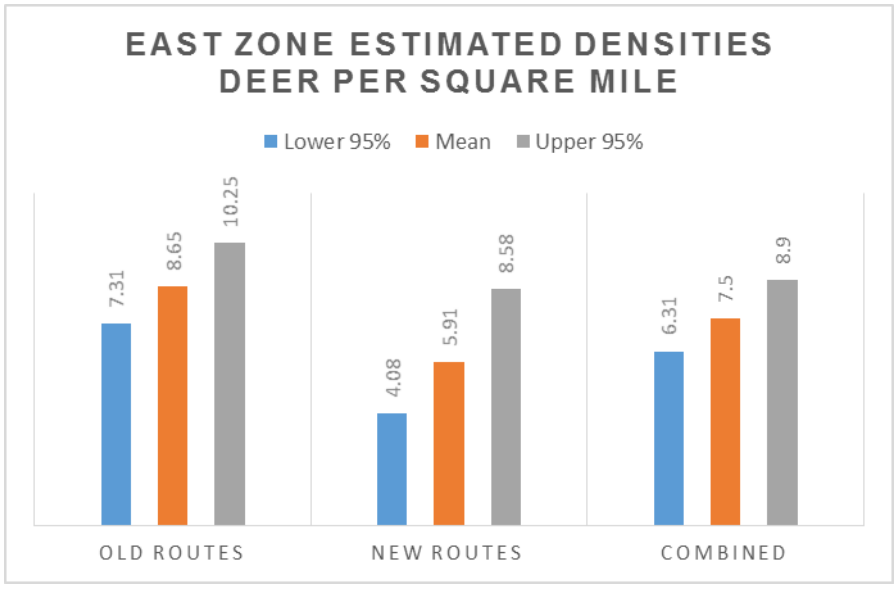


Figure 4. Trends in estimated deer densities on typical private lands in Kansas.

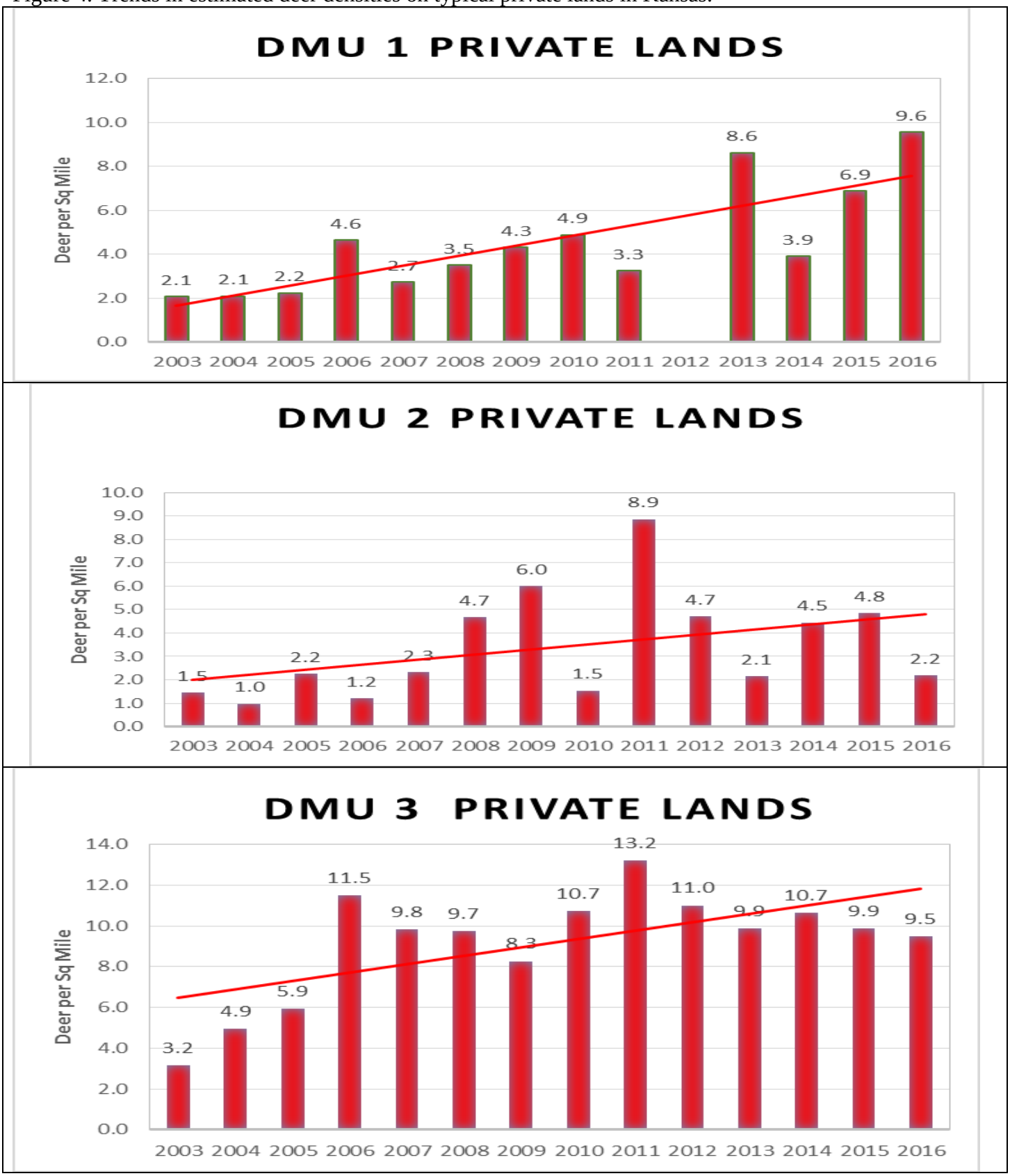
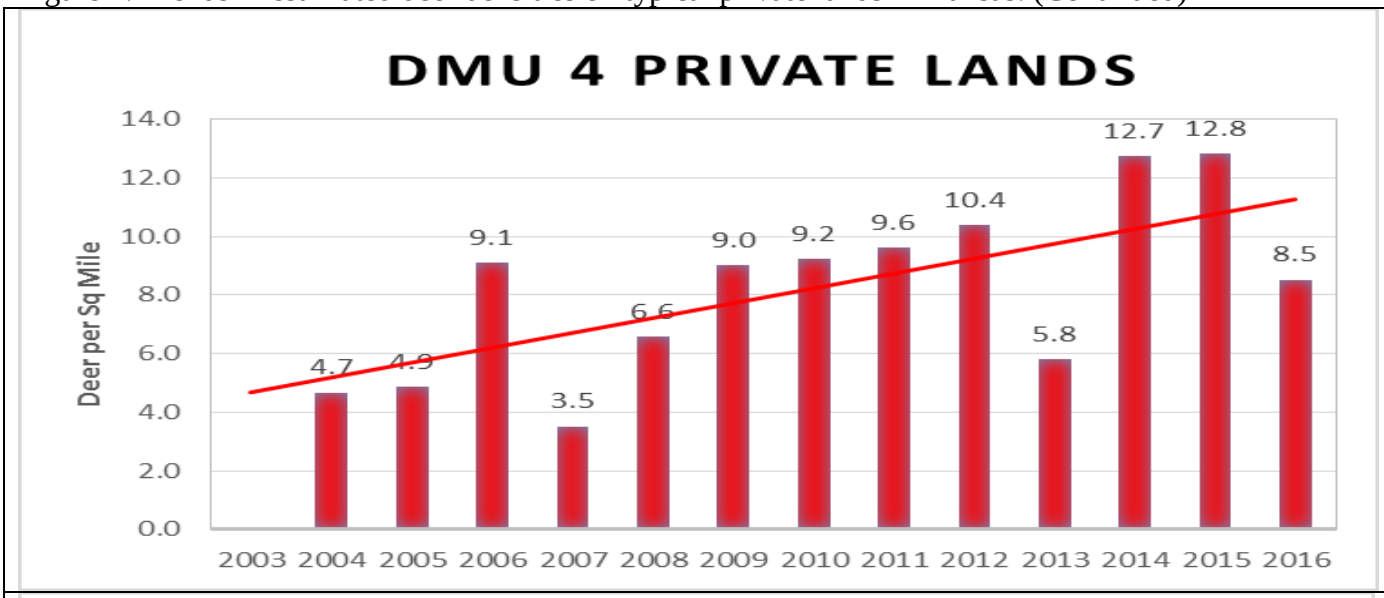
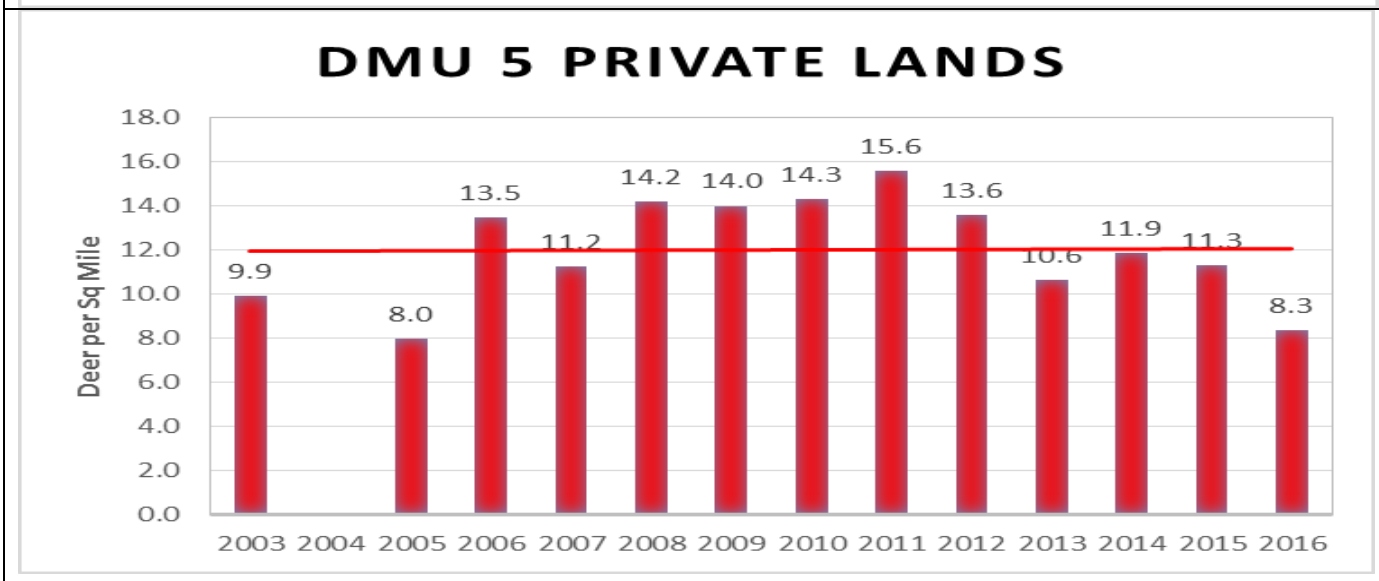


Figure 4. Trends in estimated deer densities on typical private lands in Kansas. (Continued)





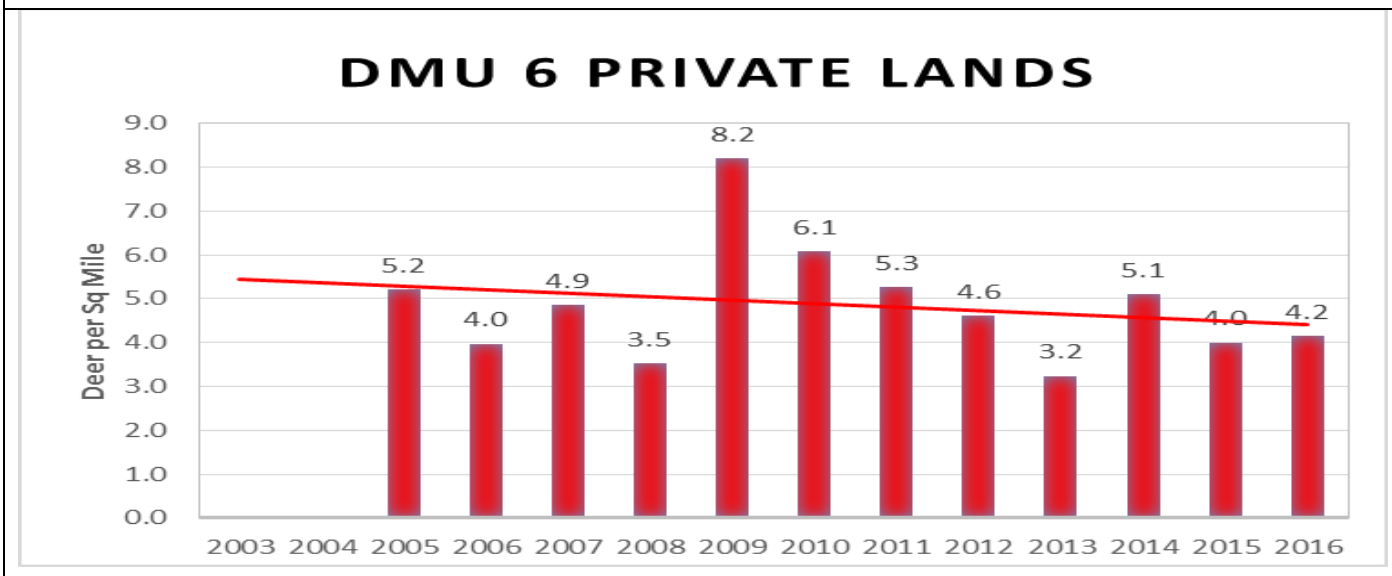
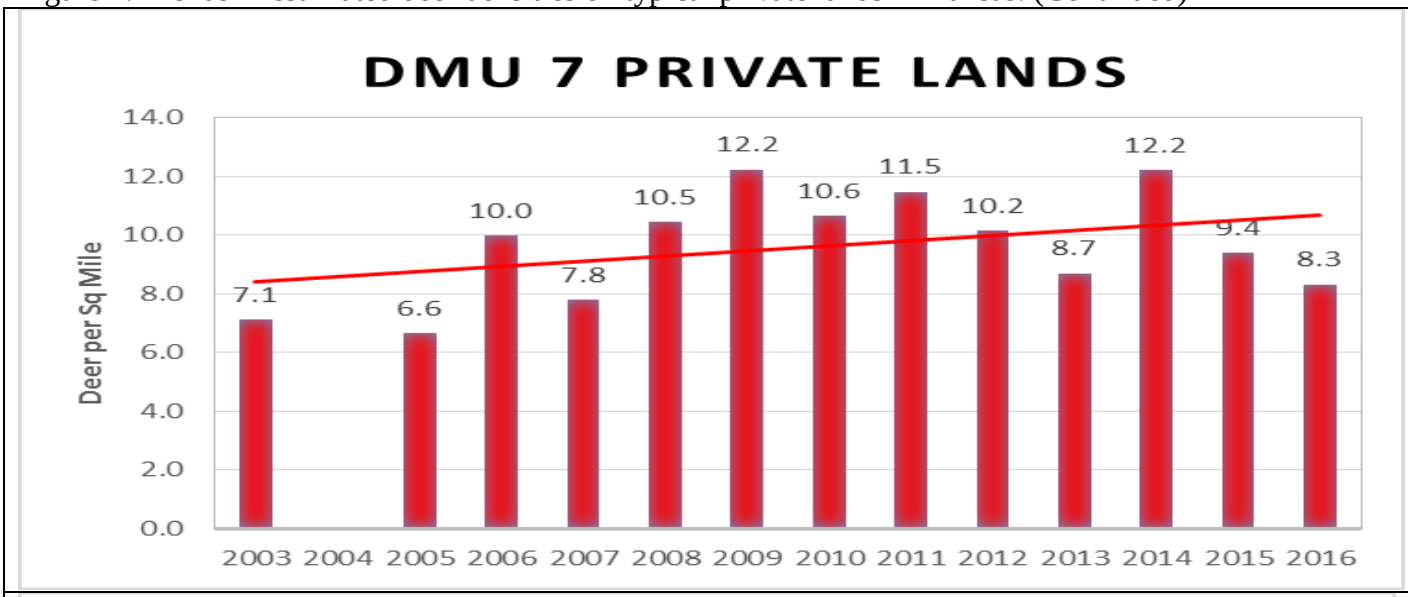
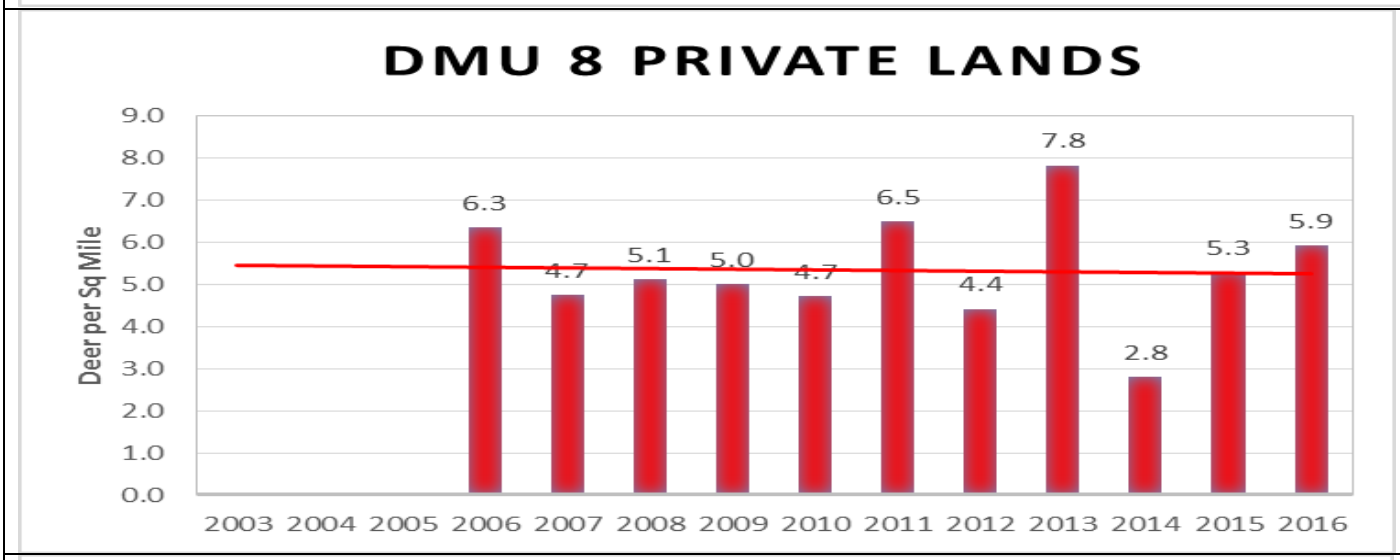


Figure 4. Trends in estimated deer densities on typical private lands in Kansas. (Continued)





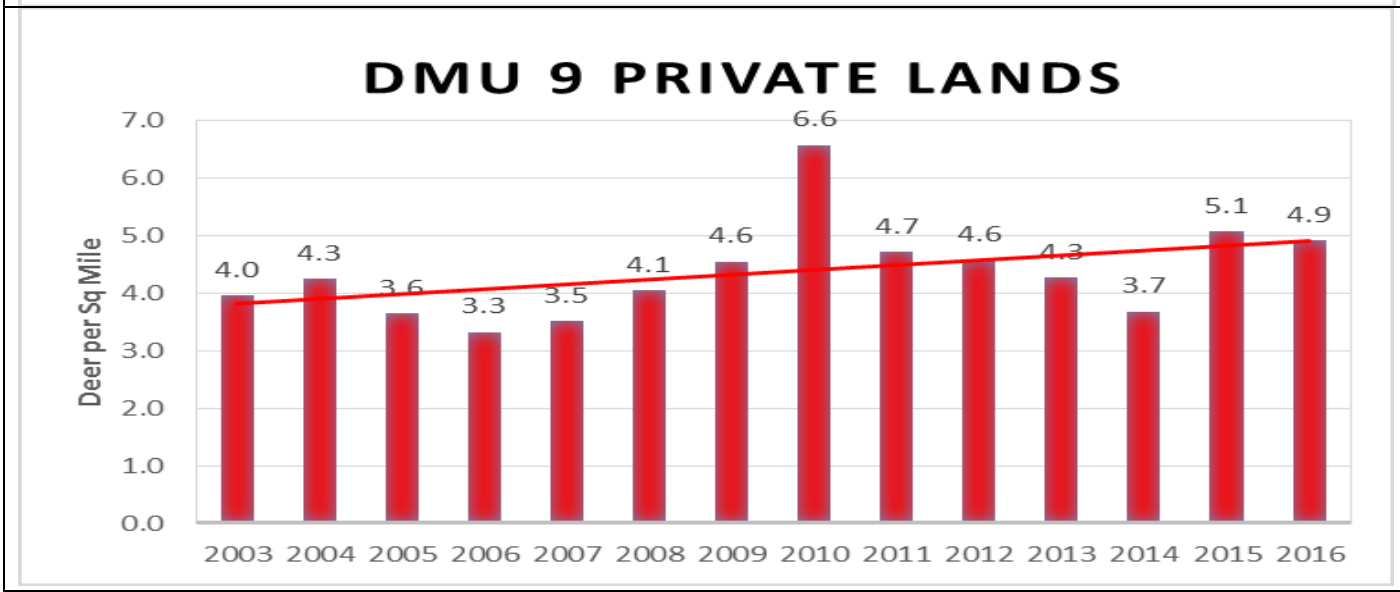
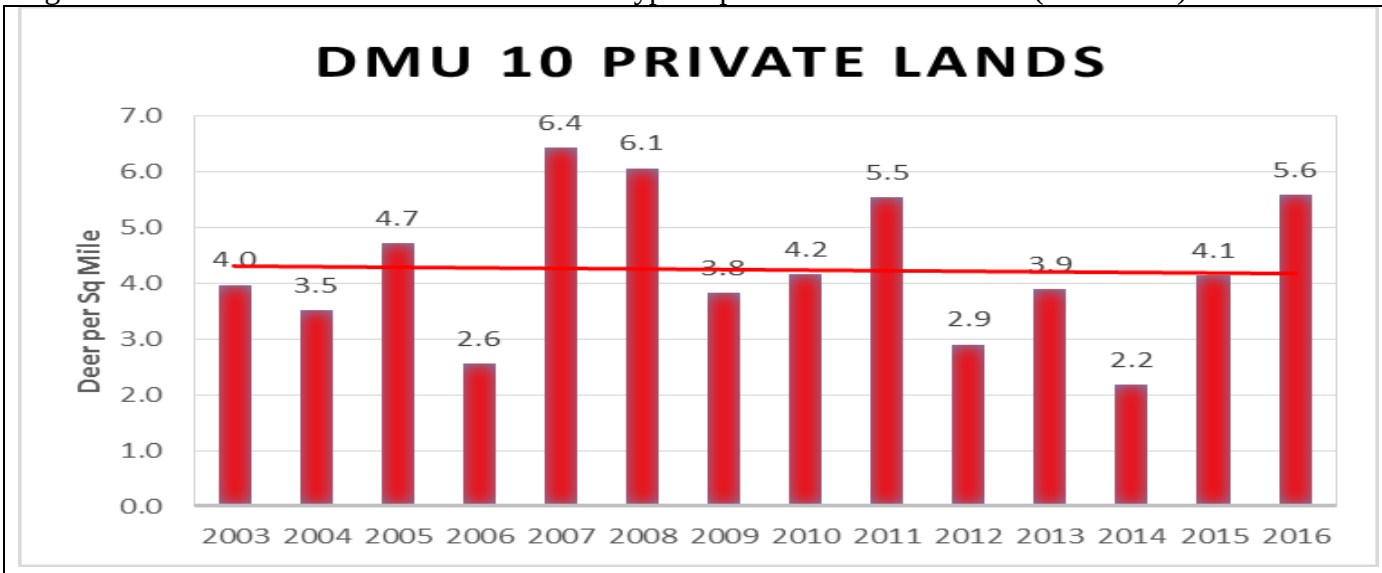
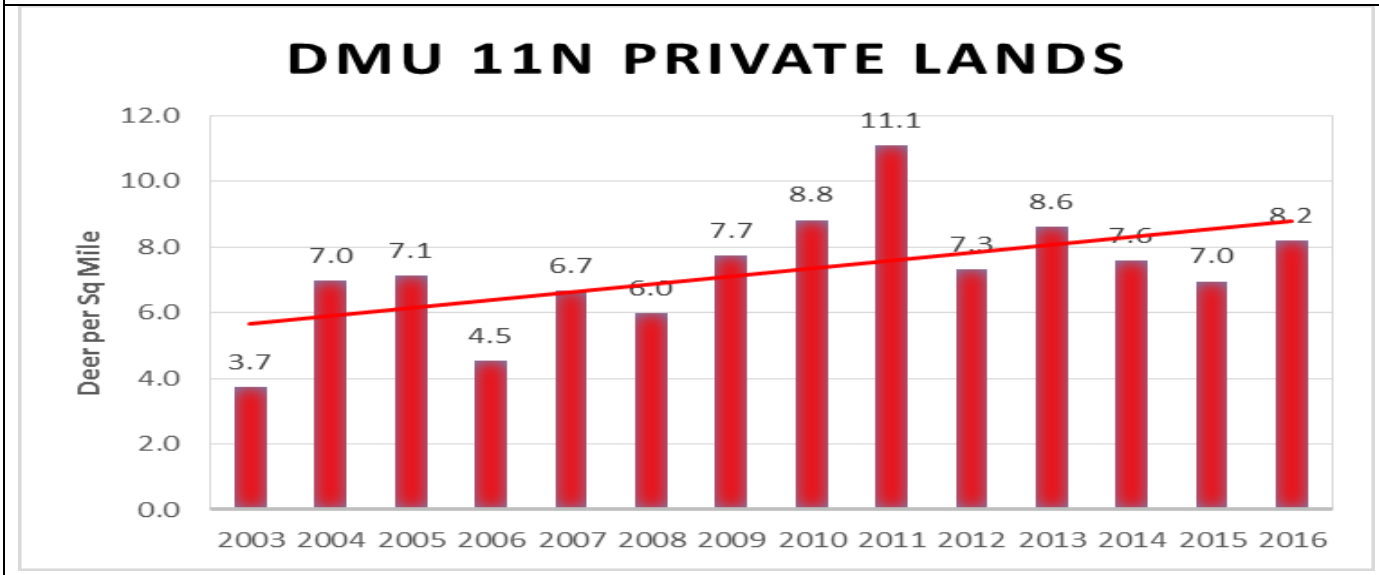


Figure 4. Trends in estimated deer densities on typical private lands in Kansas. (Continued)





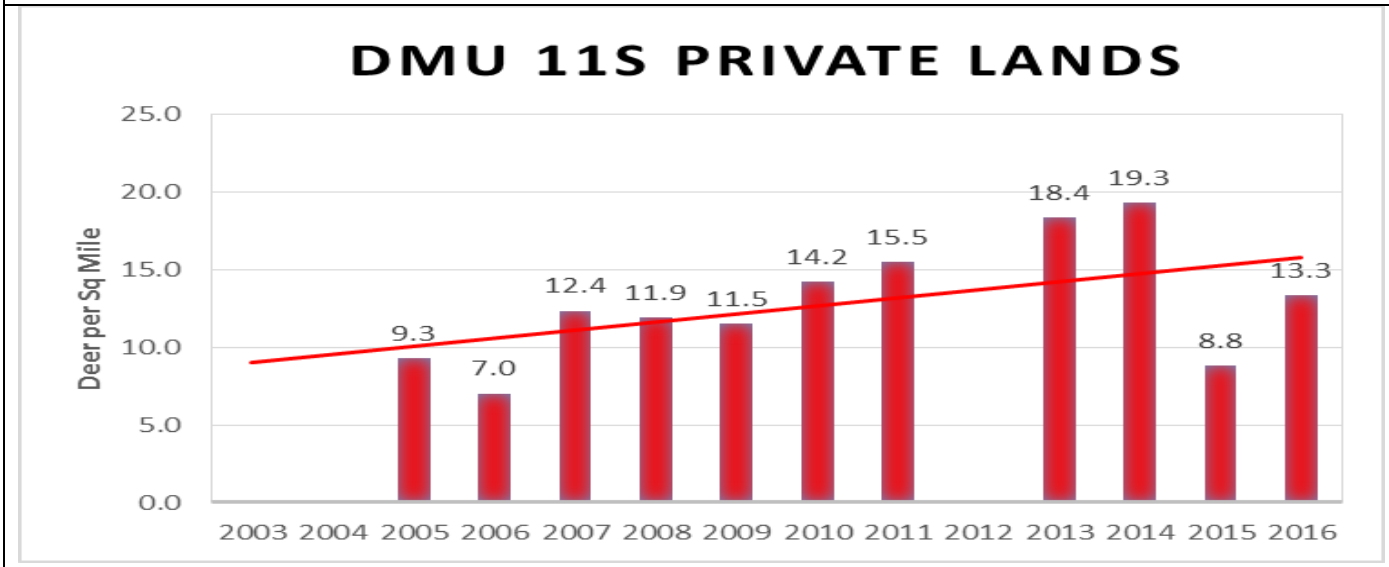
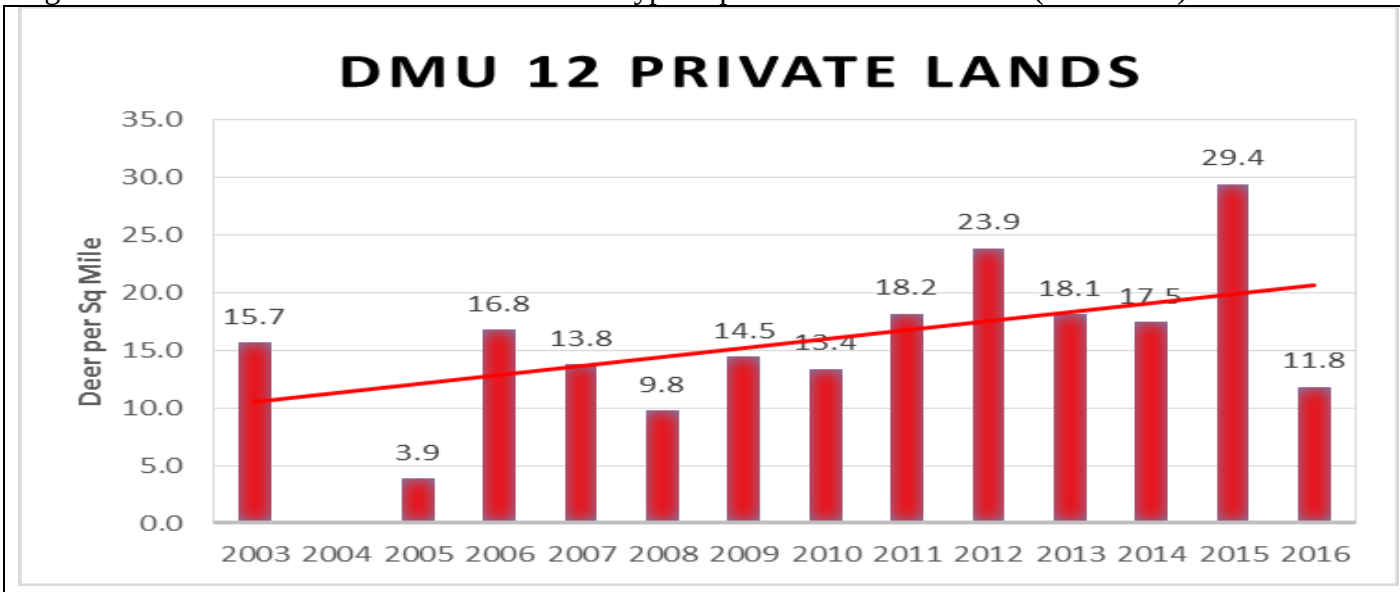
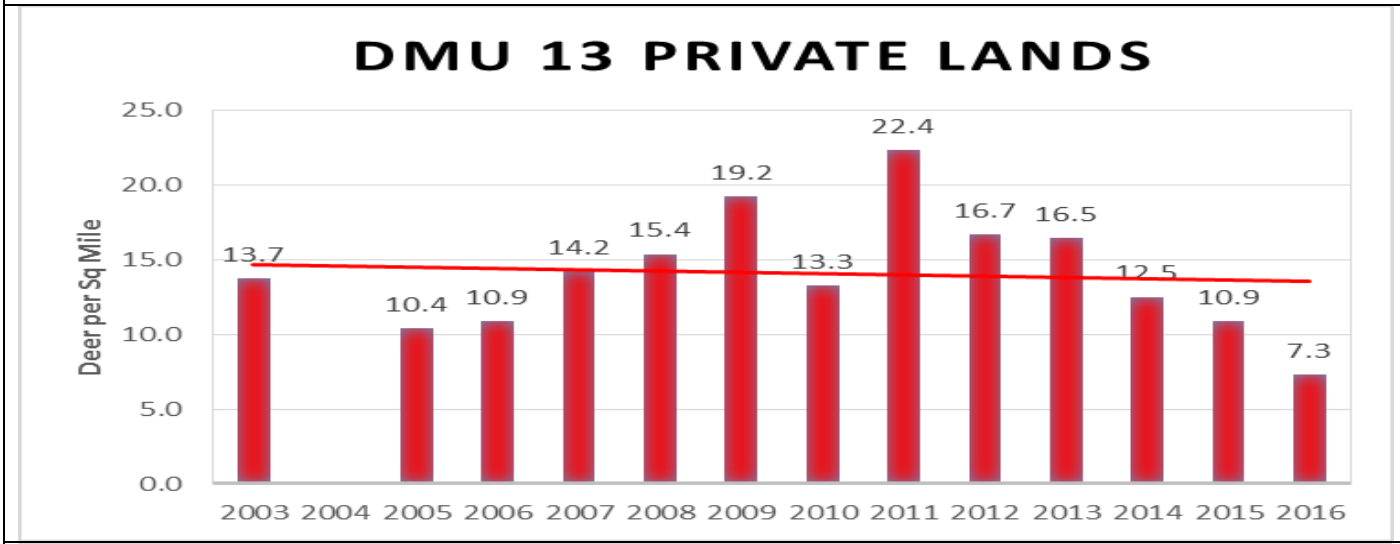


Figure 4. Trends in estimated deer densities on typical private lands in Kansas. (Continued)





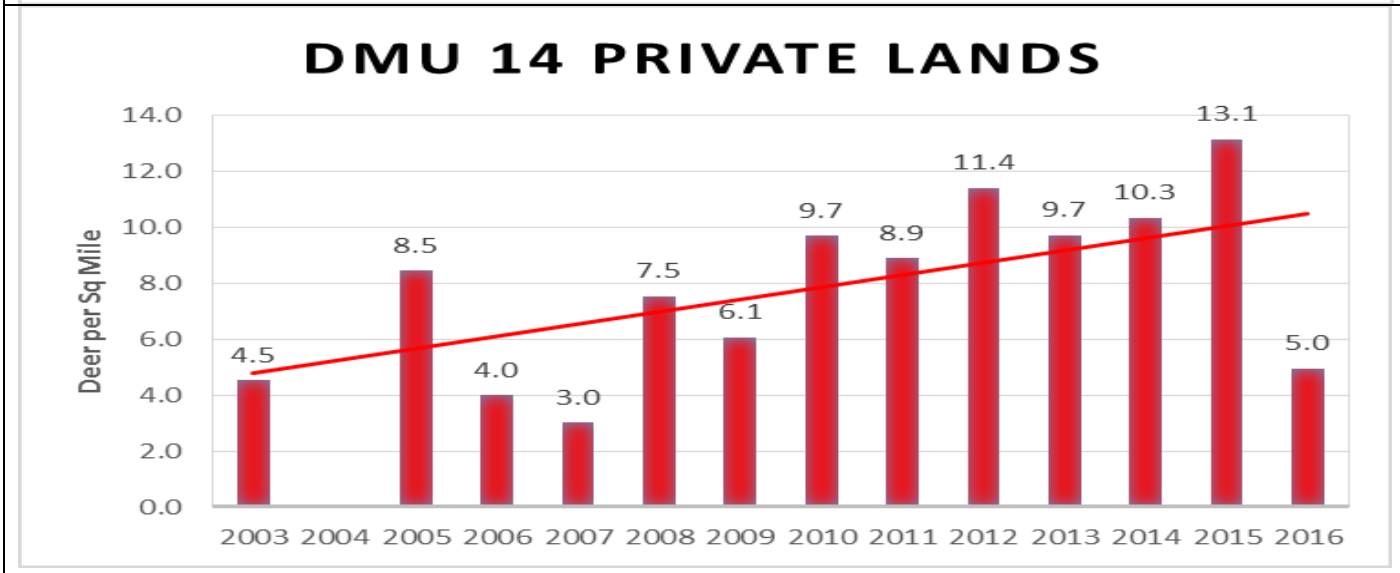


Figure 4. Trends in estimated deer densities on typical private lands in Kansas. (Continued)

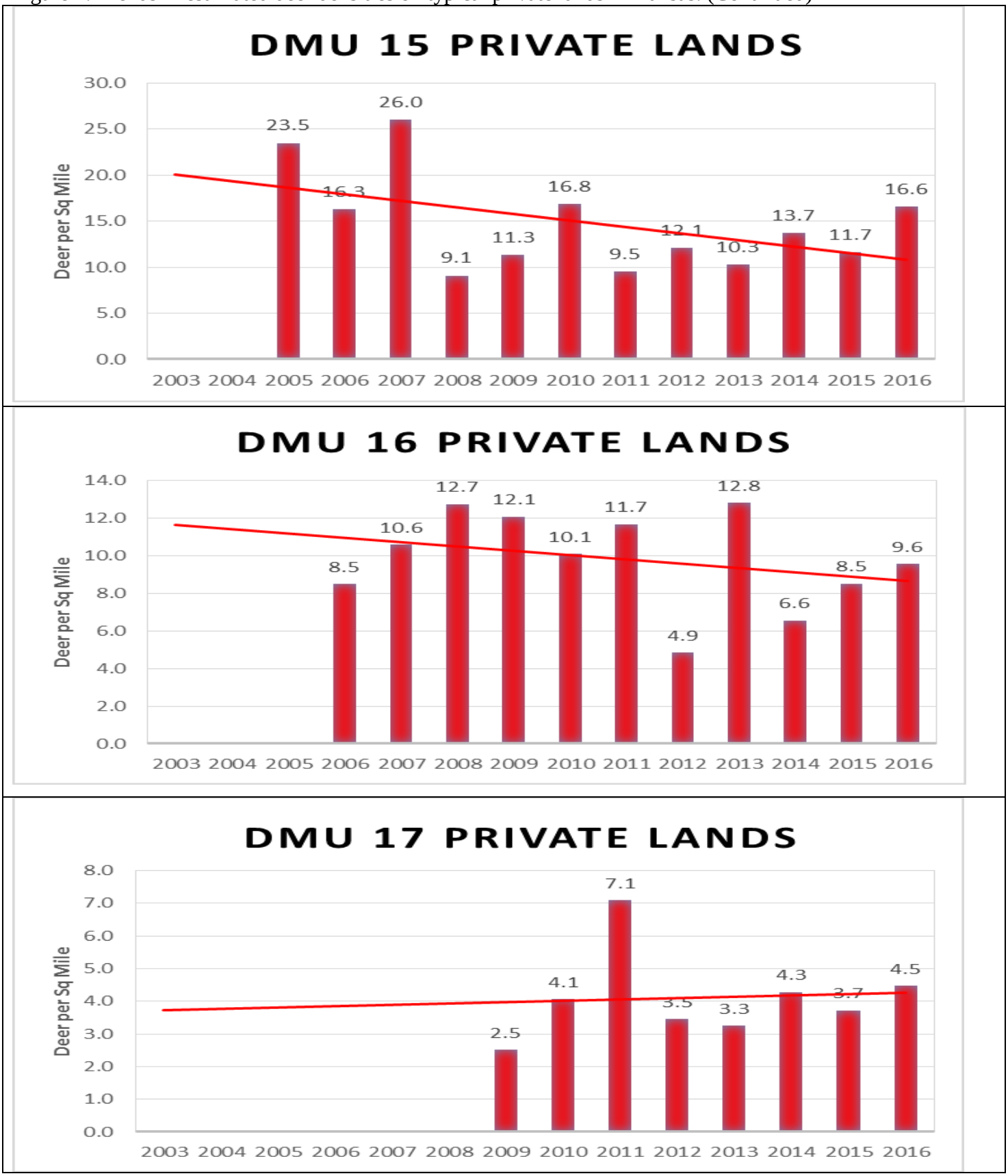
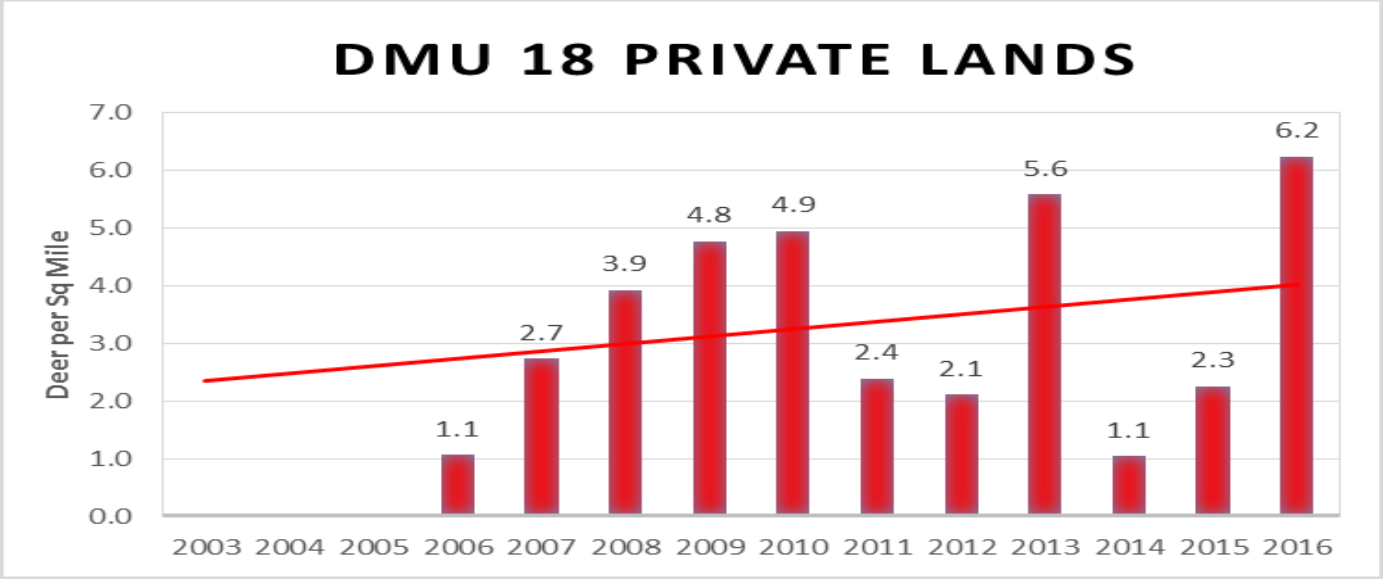
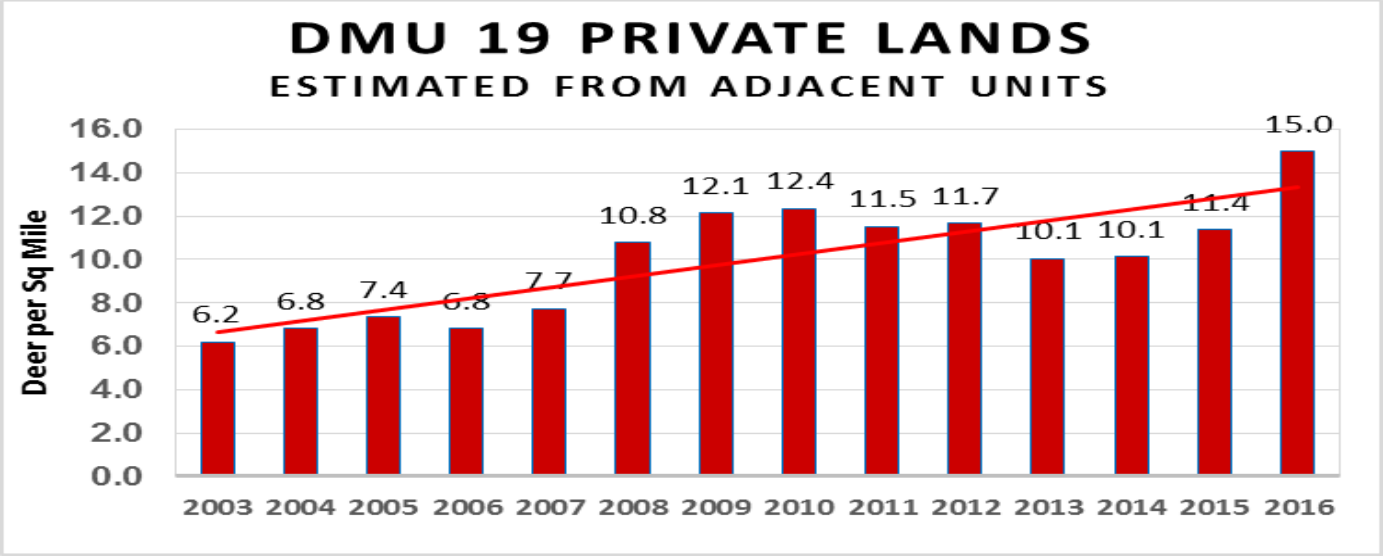


Figure 3. Trends in estimated deer densities on typical private lands in Kansas. (Continued)





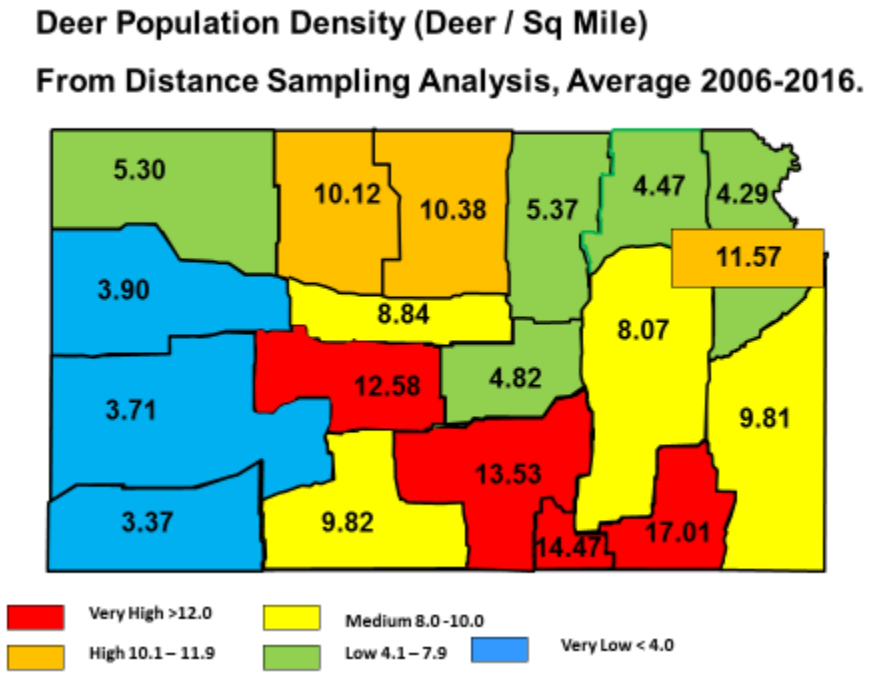


Figure 5. Estimated 11-year average deer densities on typical private lands in the various deer management units in Kansas from 2006 to 2016.

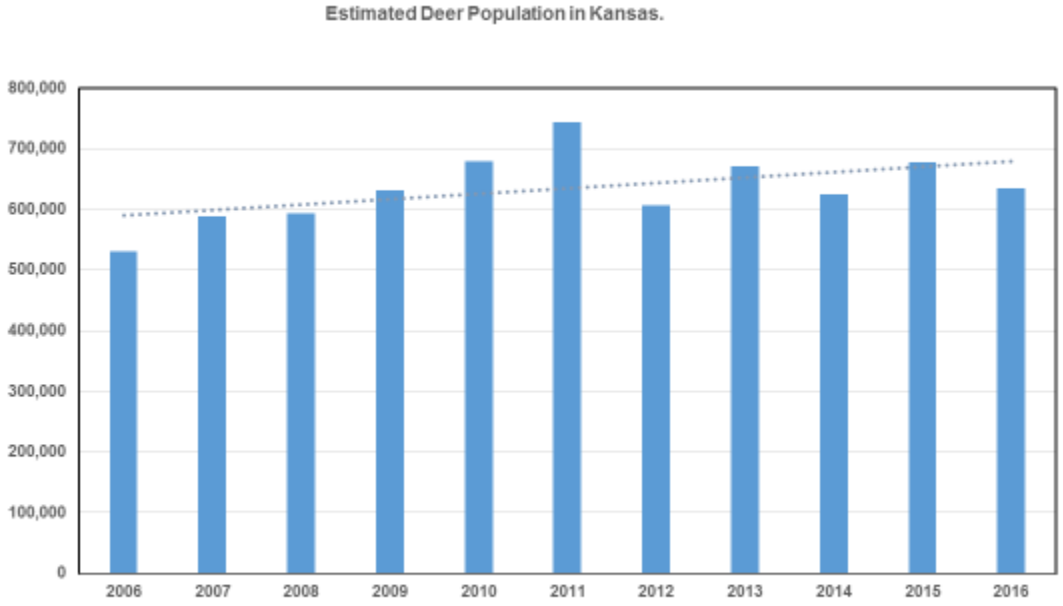


Figure 6. Trends in the estimated population of deer in Kansas from 2006 to 2016.

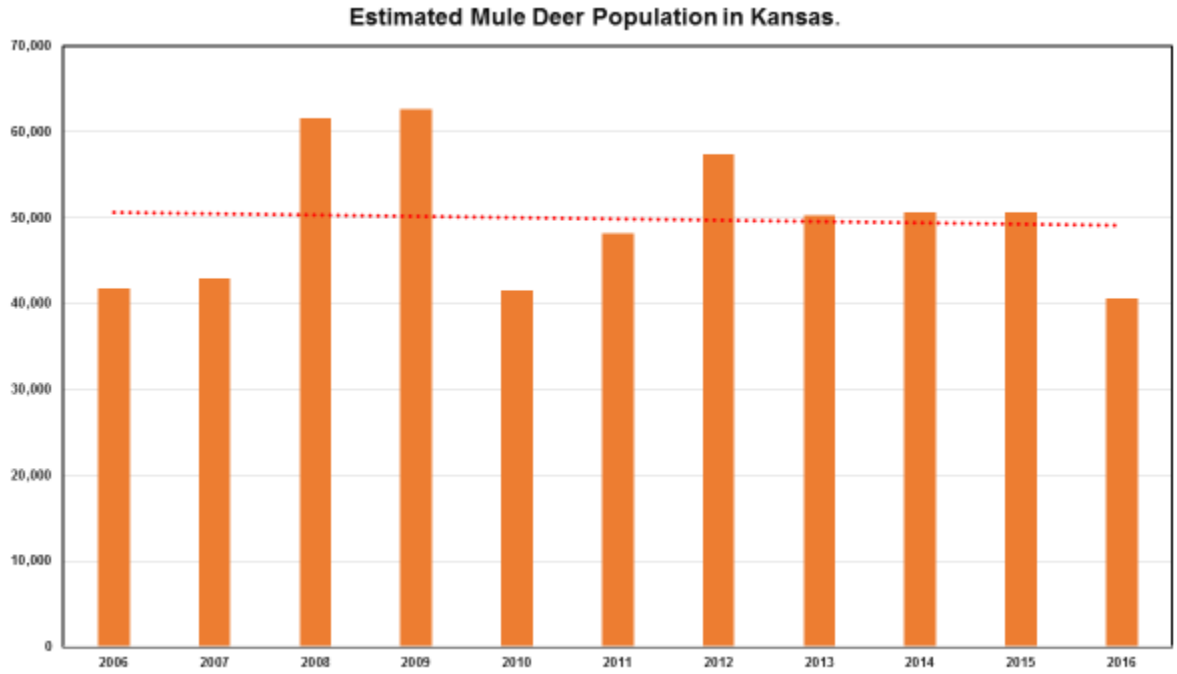
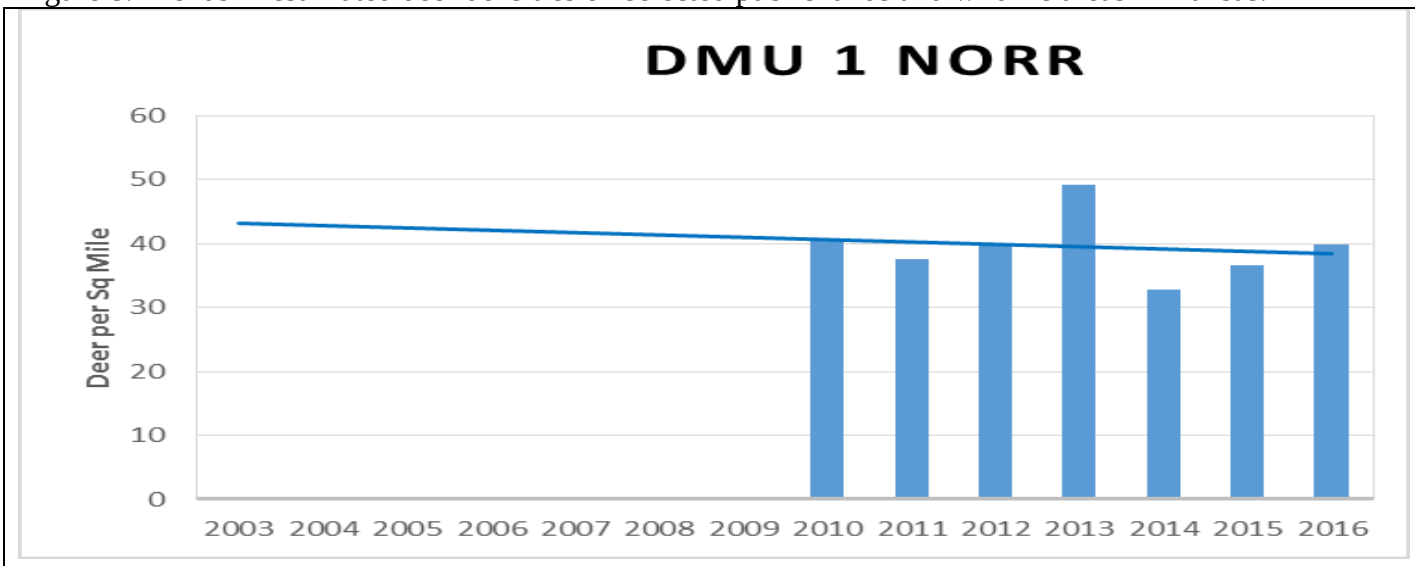
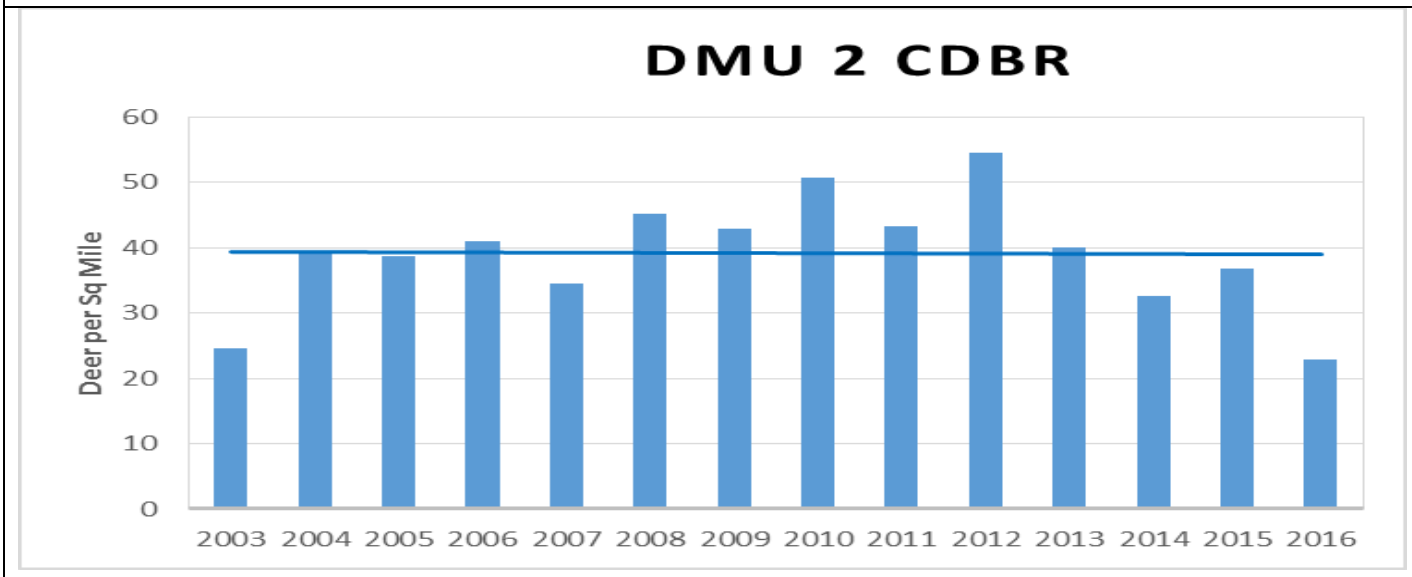


Figure 7. Trend in the estimated population of mule deer in Kansas from 2006 through 2016.

Figure 8. Trends in estimated deer densities on selected public lands and wildlife areas in Kansas.





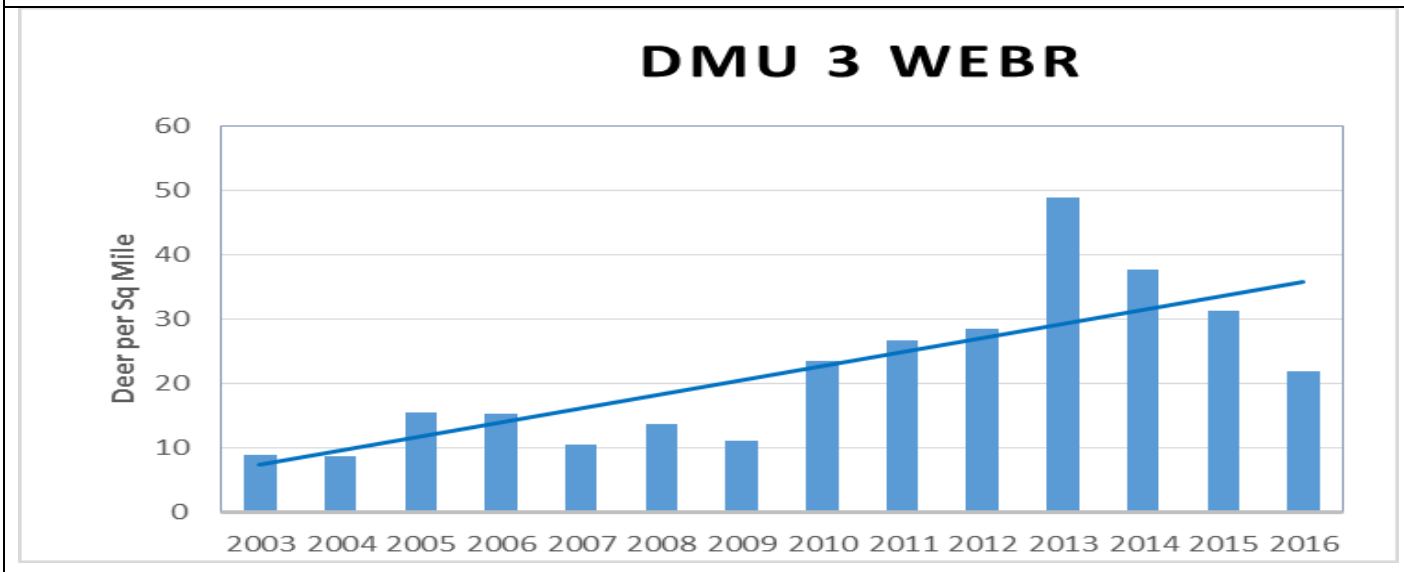
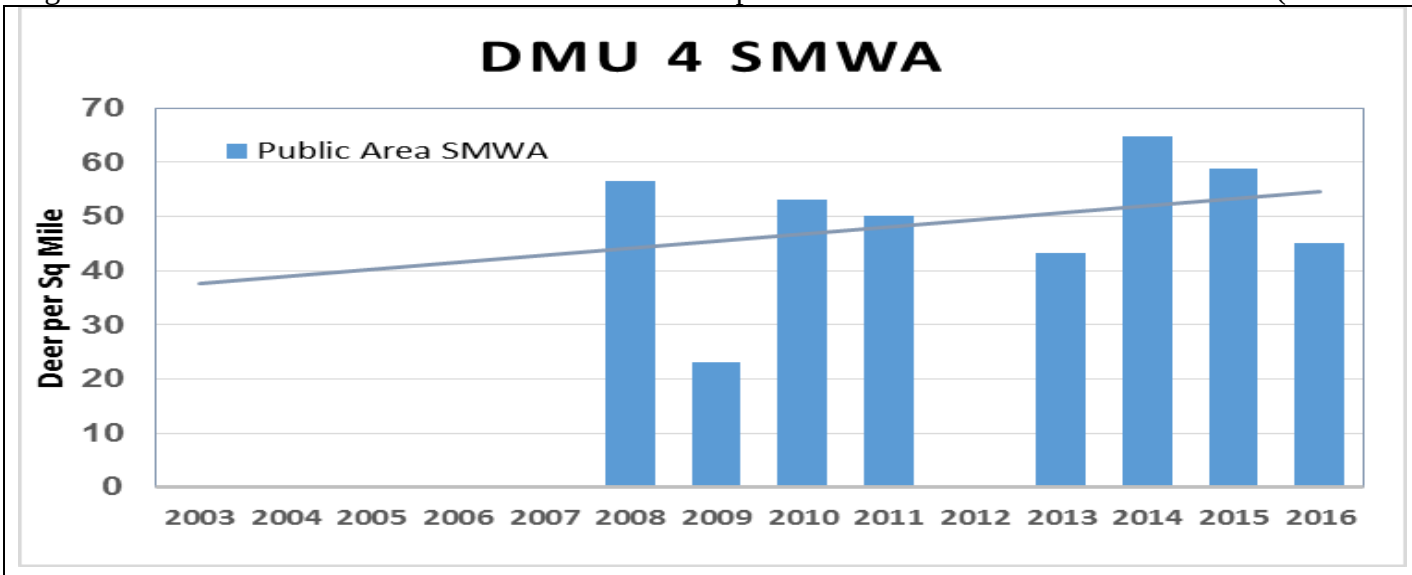
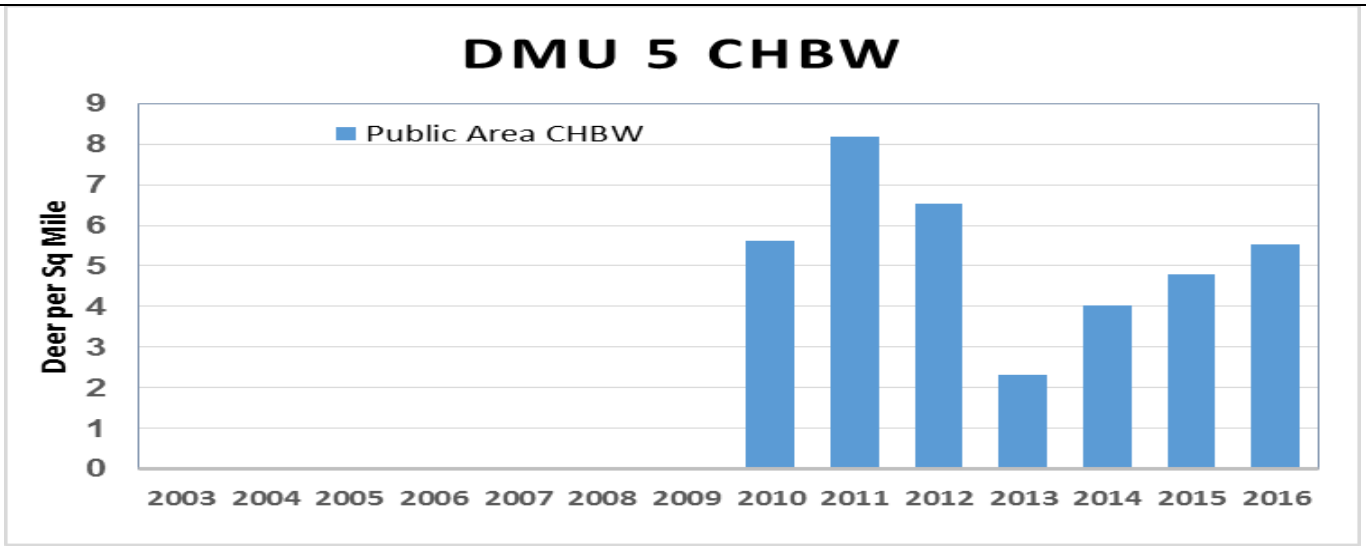


Figure 8. Trends in estimated deer densities on selected public lands and wildlife areas in Kansas. (Continued)





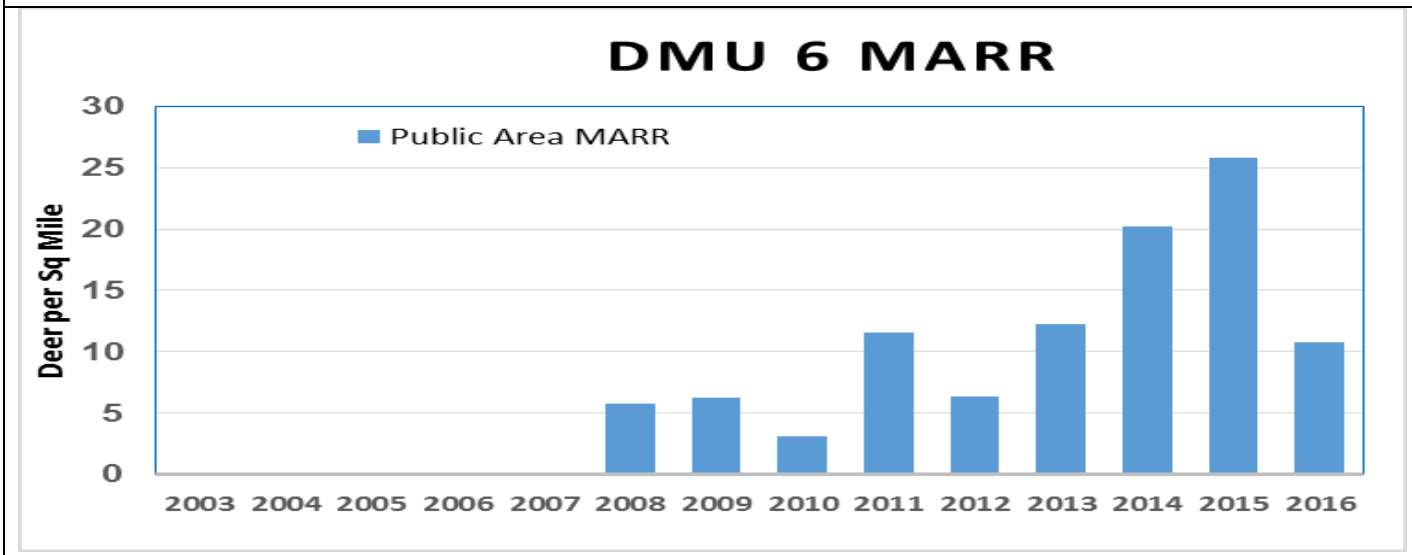
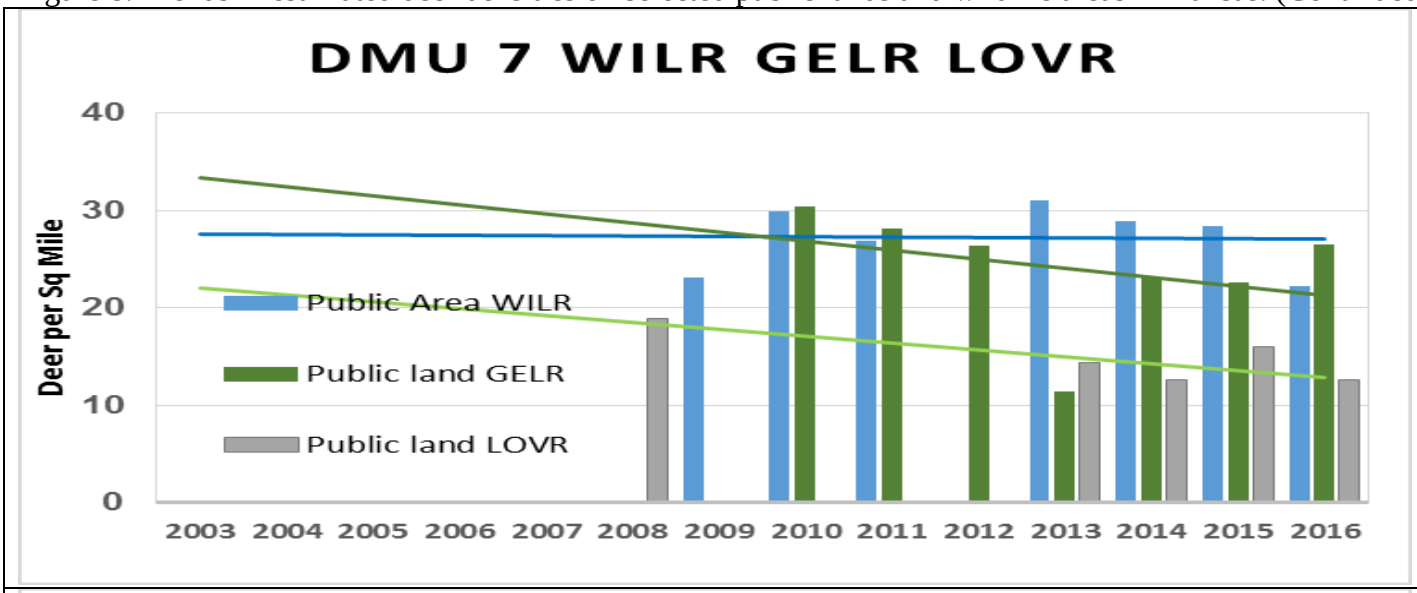
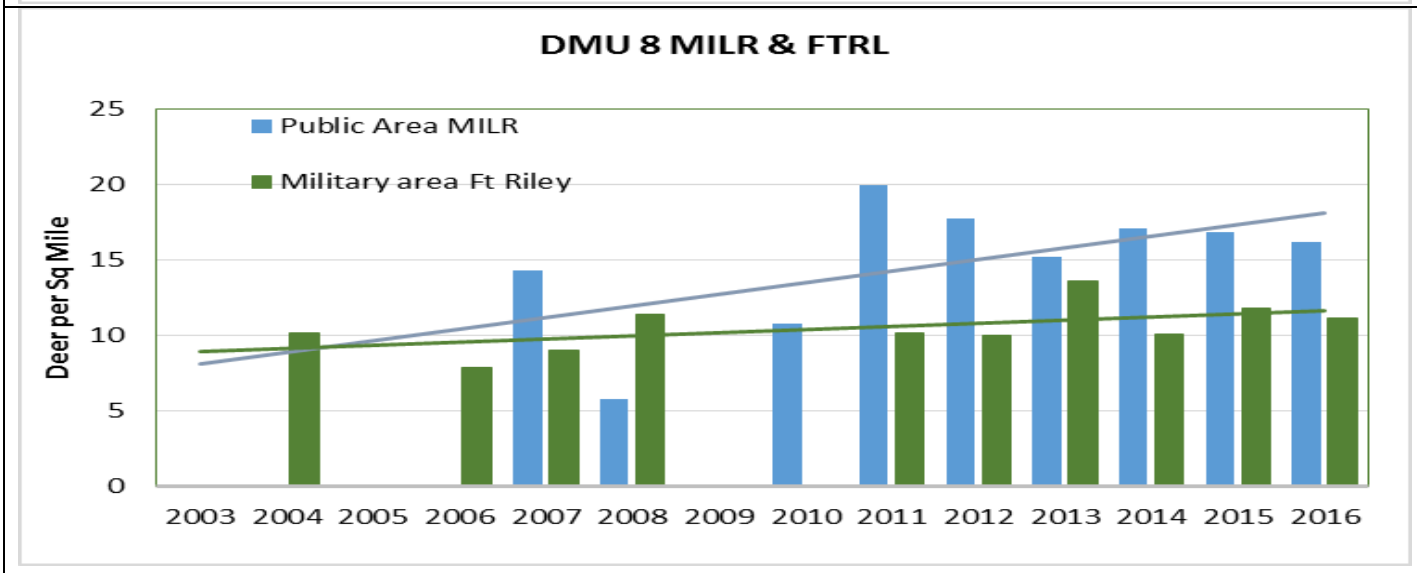


Figure 8. Trends in estimated deer densities on selected public lands and wildlife areas in Kansas. (Continued)





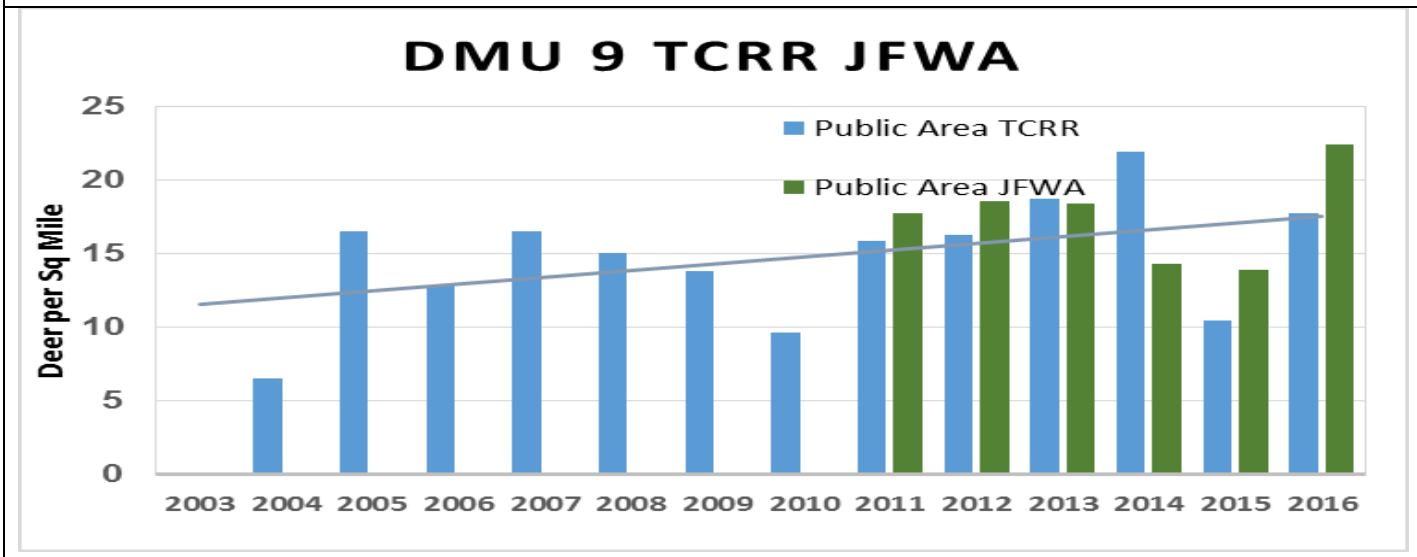
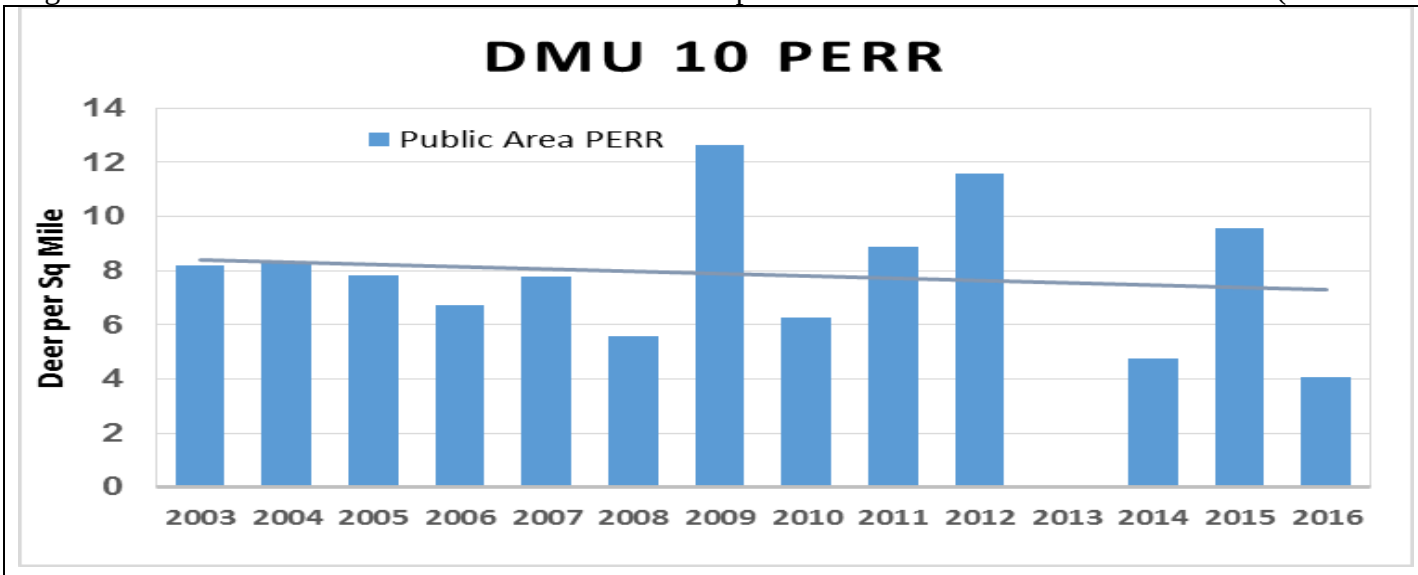
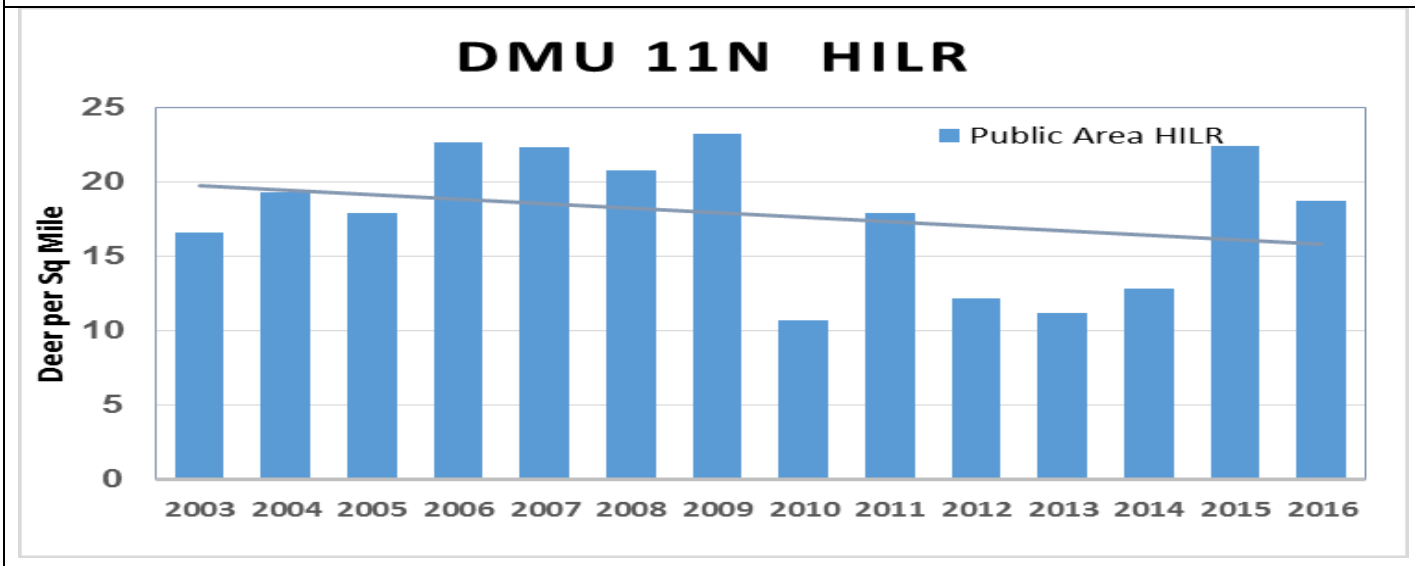


Figure 8. Trends in estimated deer densities on selected public lands and wildlife areas in Kansas. (Continued)





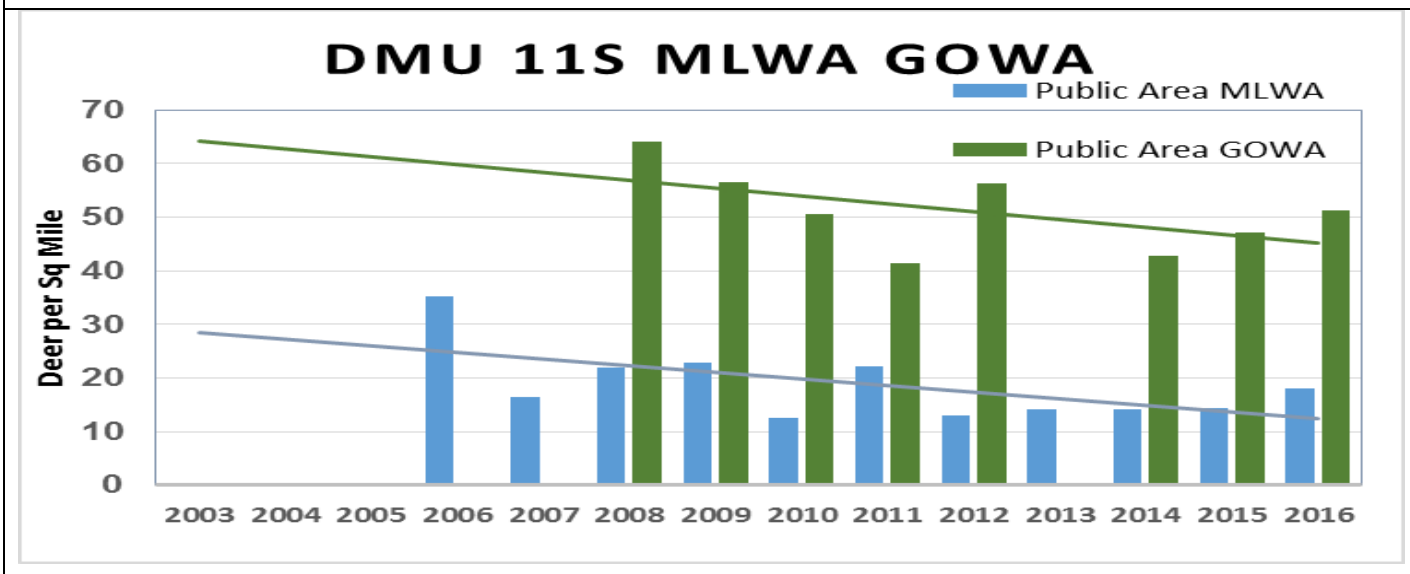
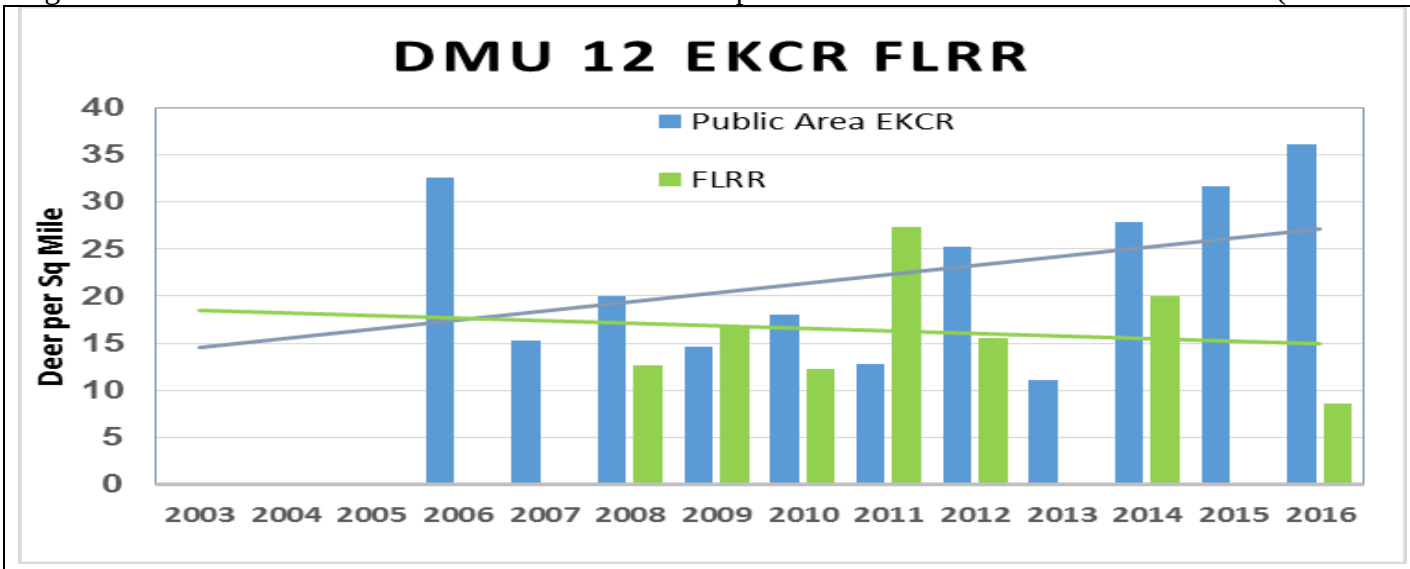
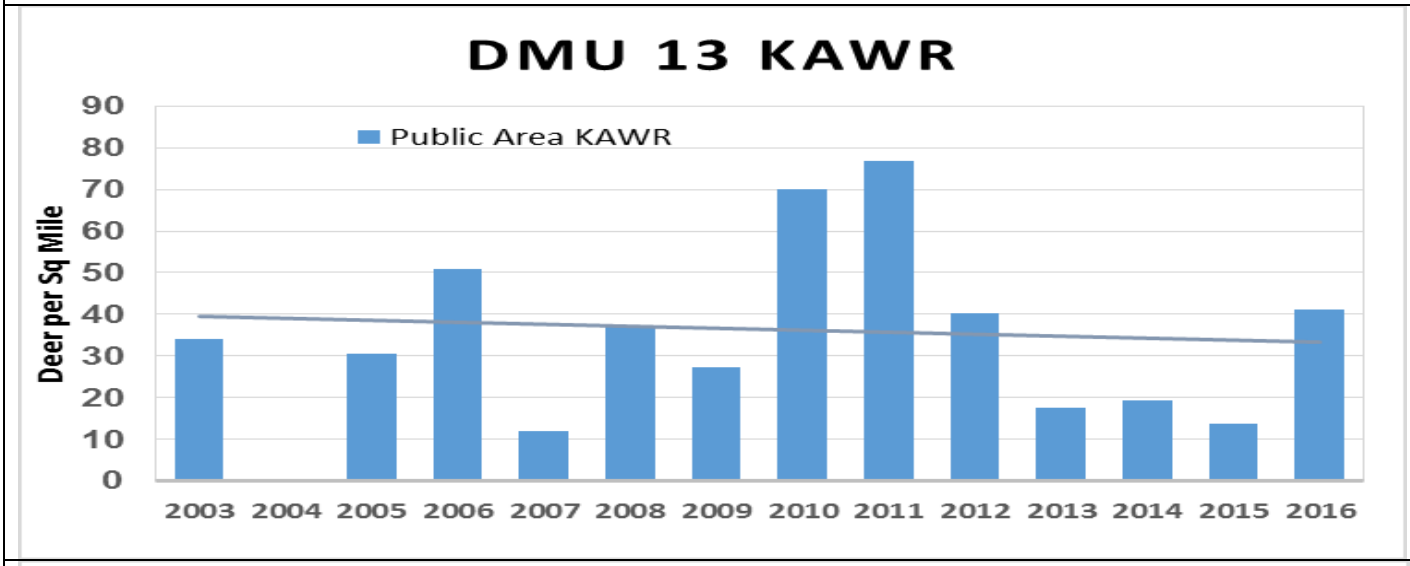


Figure 8. Trends in estimated deer densities on selected public lands and wildlife areas in Kansas. (Continued)





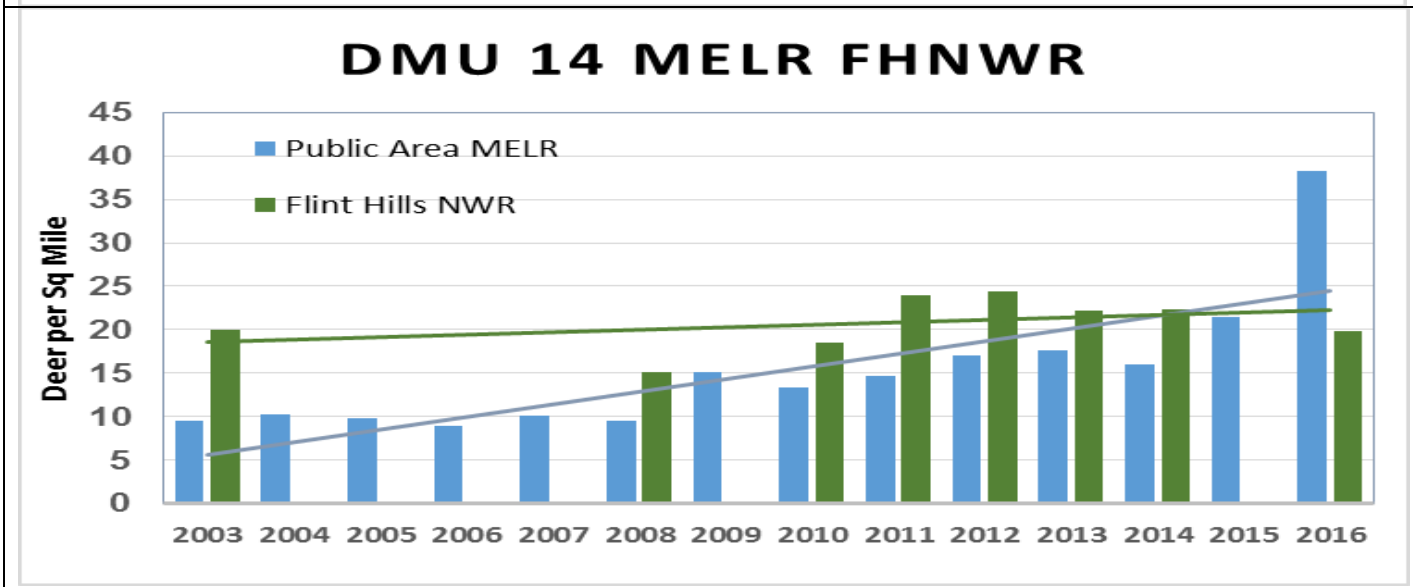
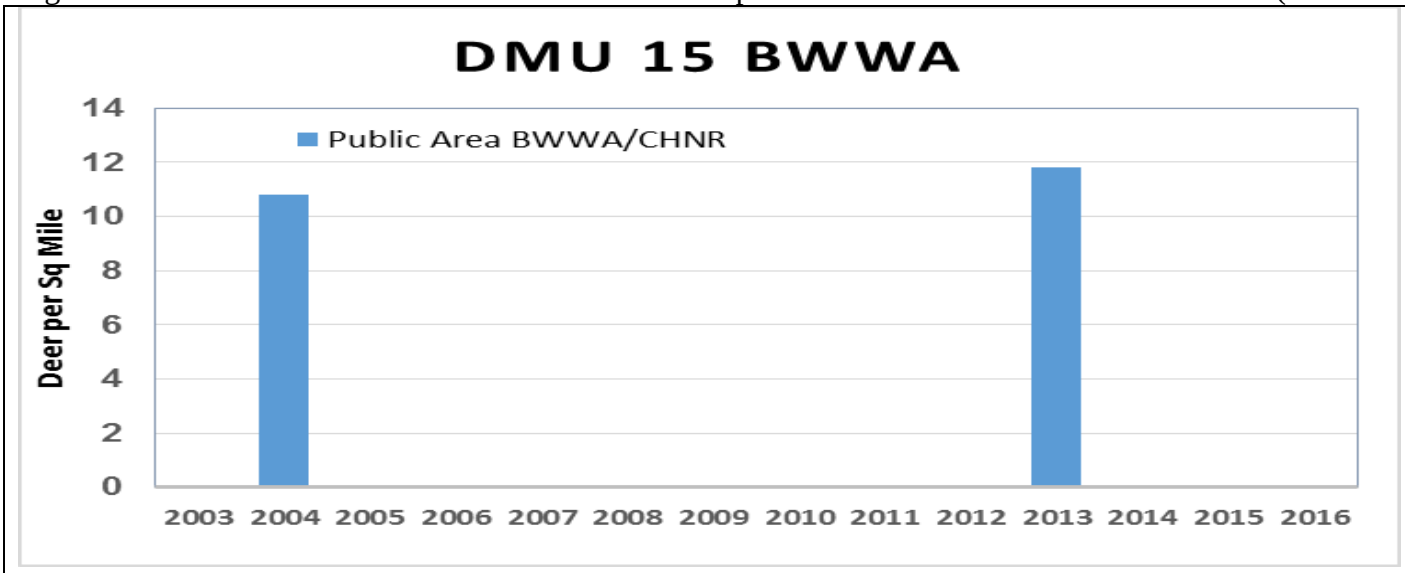
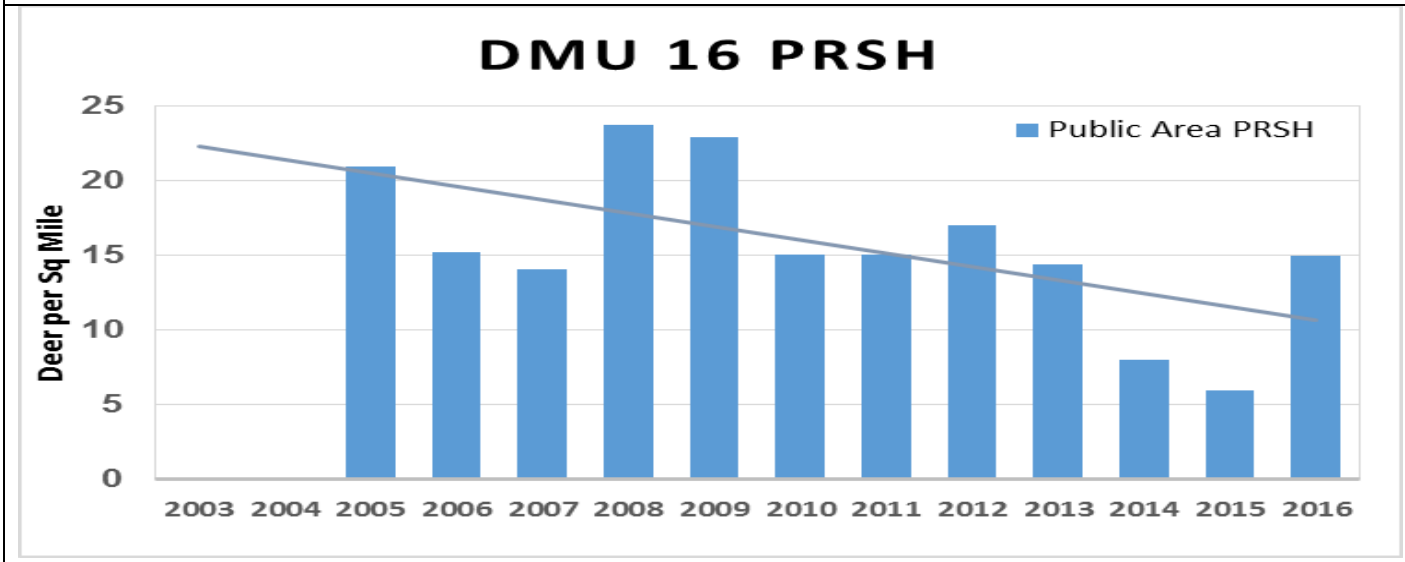


Figure 8. Trends in estimated deer densities on selected public lands and wildlife areas in Kansas. (Continued)





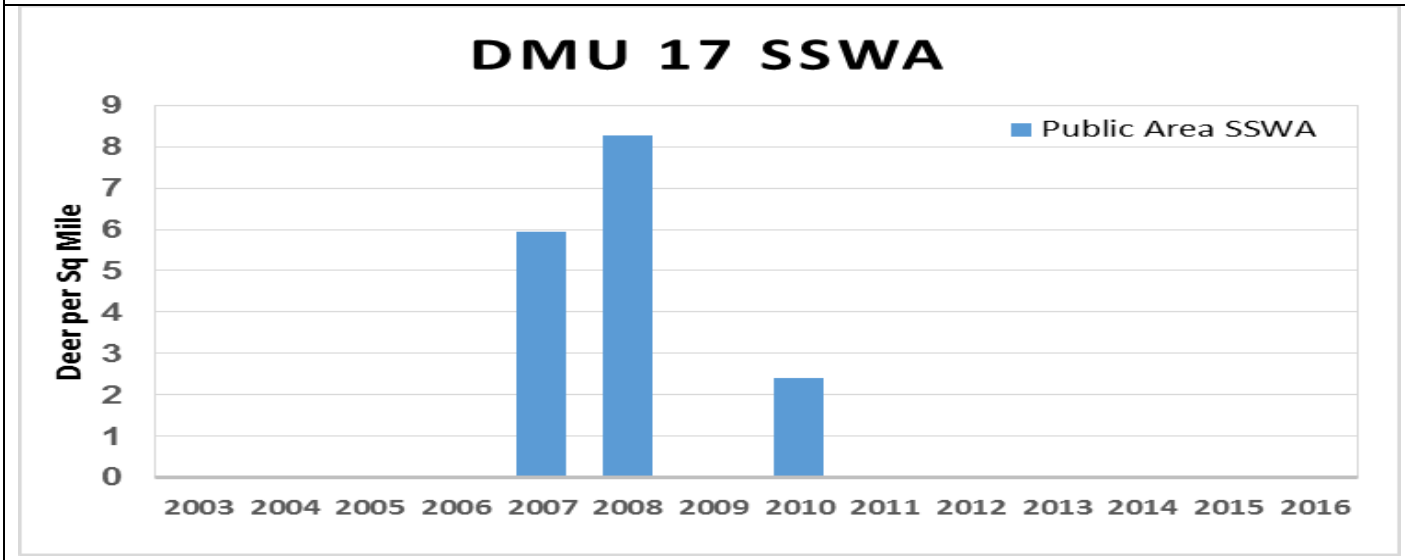
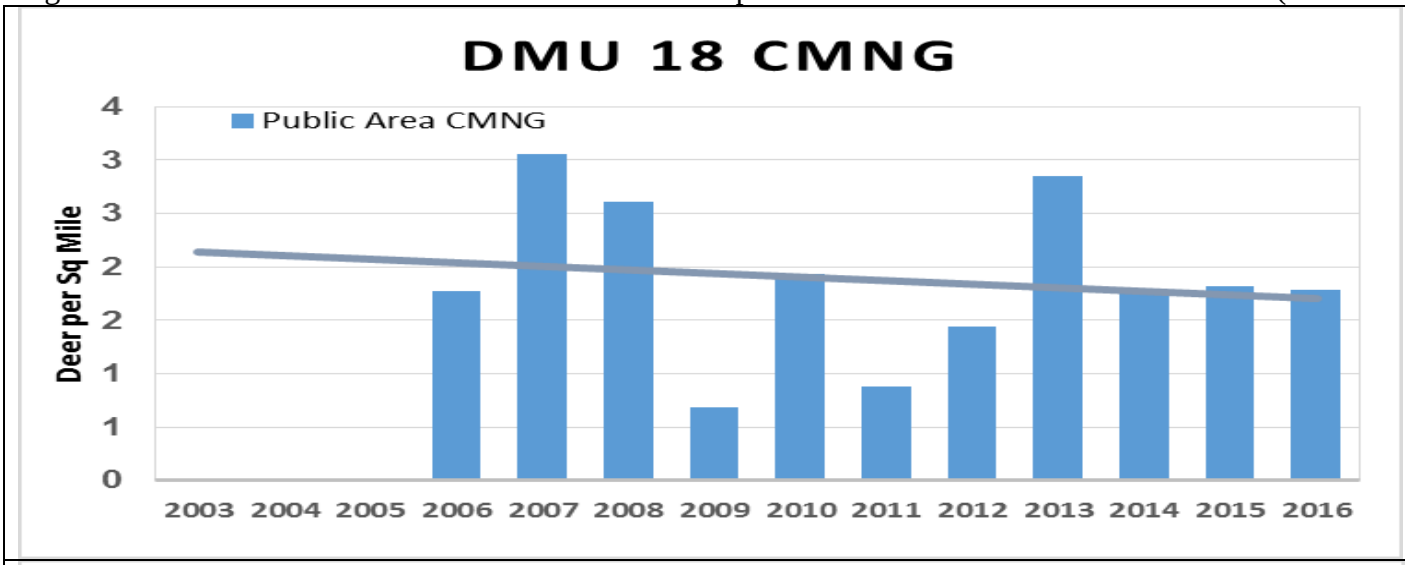
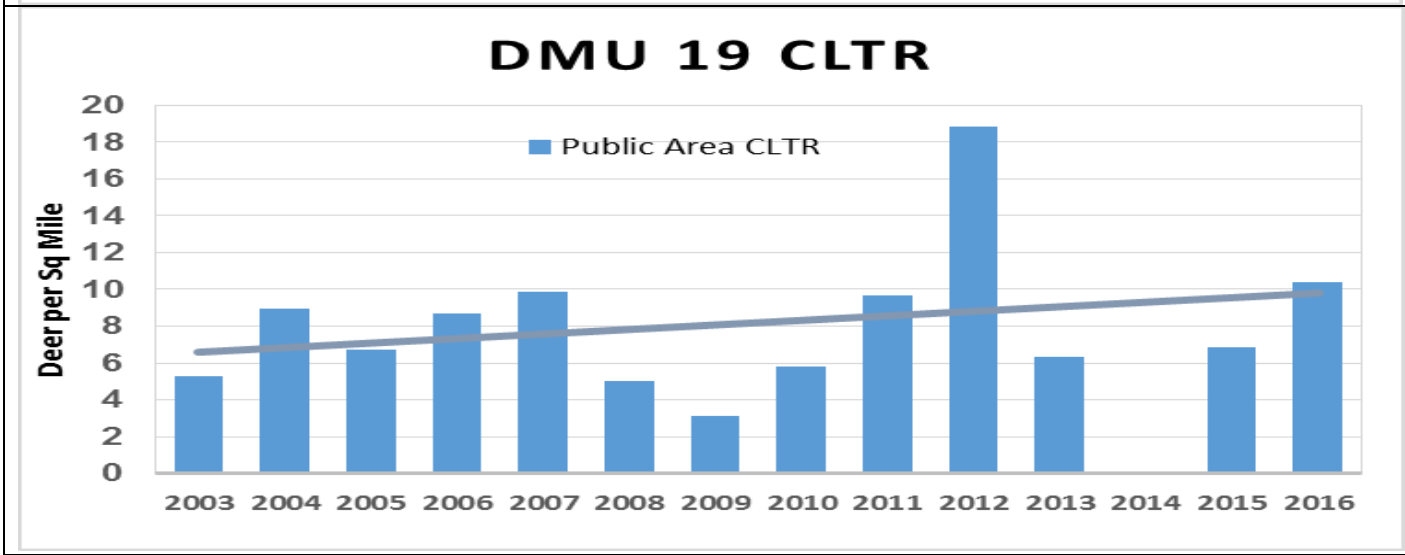


Figure 8. Trends in estimated deer densities on selected public lands and wildlife areas in Kansas. (Continued)





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