

**PENNSYLVANIA GAME COMMISSION
BUREAU OF WILDLIFE MANAGEMENT
RESEARCH DIVISION
PROJECT ANNUAL JOB REPORT**

PROJECT CODE NO.: 06210

TITLE: White-tailed Deer Research/Management

PROJECT JOB NO.: 21001

TITLE: Estimating County Deer Population Sizes & Growth Rates

PERIOD COVERED: July 1, 1999 through June 30, 2000

COOPERATING AGENCIES: None

WORK LOCATION(S): Statewide

PREPARED BY: [Bret D. Wallingford](#)

DATE: September 15, 2000

Abstract: We used data on deer reproduction, sex and age of harvested deer, license numbers of successful hunters, and reported harvests to estimate 1999 and 2000 deer populations by management unit. Wildlife Conservation Officers (WCOs) also conducted winter deer mortality surveys along preselected routes in their respective districts. Our 1999-2000 winter deer density of 39 deer/mi² of forest land was about 15% higher than in 1998-99. The 1999-2000 winter deer loss index of 0.14 deer/mile was well below previously recorded losses. We projected a preseason deer population of 1.523 million for 2000. The staff structure of the deer management program was changed in 1999, with deer being removed from the Forest Wildlife Section and being placed in the newly created Deer Management Section. Dr. Gary Alt was assigned to be the section supervisor. Five changes were approved for the 2000-01 deer seasons, including: 1. A statewide, fall flintlock season for antlerless deer; 2. Concurrent antlered and antlerless seasons for junior, senior and disabled license holders; 3. Open antlerless season on the last Saturday of the antlered deer season; 4. Allow the harvest of multiple deer per hunter per day; and 5. Allow the purchase of a second antlerless license by all hunters. The goal for 2000 is to stabilize population growth. Population analyses indicate that about 319,000 antlerless deer need to be harvested to stabilize the deer population statewide. We used information from Michigan and from the 1999 fall flintlock season to estimate the potential impacts of the new regulations. Even under the best circumstances, the antlerless harvest will fall well short of the harvest needed to stabilize the deer herd. One negative impact of the Saturday opening day for antlerless deer is the increased harvest on antlered deer. We recommend expanding the opportunities for antlerless deer hunting by adding a county-specific, 3-day October gun hunt that begins on a Thursday and ends on a Saturday. We also recommend a statewide, concurrent deer season for antlered and antlerless deer that follows the

traditional antlered deer time frame. For antlerless licenses, we recommend that hunters be permitted to purchase and use the entire antlerless allocation without regard to individual limits; and that flintlock hunters be included in the antlerless license system. The restriction to private lands for all antlerless licenses should also be removed.

OBJECTIVE

To determine deer population sizes and harvest recommendations by management unit.

PROCEDURES

To obtain data on reproduction by age class, WCOs examined female deer killed by various causes from 1 February through 31 May 1999. They recorded location (county, township, and proposed deer management unit), date killed, cause of death, and number of embryos for each doe on a form attached to a deer jaw envelope. They also removed one side of the lower jaw from each deer for age determination. Jaws were forwarded to wildlife biologists who made the age assignments in July 1999. Personnel in the Bureau of Automated Technology Services (BATS) processed the reproductive data and provided summary reports for the state and each county.

During the 1999 antlered and antlerless rifle seasons, 31 data collection teams examined deer in assigned areas. Each team spent at least three days during each season collecting ages, sexes, counties of harvest, and hunting license numbers from harvested deer found in butcher shops and other locations. Deer teams determined deer ages using tooth wear and replacement (Severinghaus 1949).

BATS personnel input and processed data from 1999-2000 deer harvest report cards submitted by hunters and the biological collections by the deer teams. BATS also provided a PC download for population analysis. For each county the download included: the reported antlered harvest, the reported antlerless harvest, reporting rates, age and sex breakdowns of the harvest, reproductive data, combined reported regular three-day antlerless rifle and antlerless archery harvests, and the total antlerless rifle and archery harvests. We used the download data in DEERPOP and PROJECT software (Shope pers. commun.) to estimate 1999 and project 2000 county deer populations. Besides estimating populations, we used PROJECT to develop antlerless allocation recommendations for 2000.

In late March and early April, WCOs conducted winter deer mortality surveys in their assigned districts. Each WCO walked three 1.5-mile routes along stream bottoms to locate possible winter losses. They recorded the sex and age of all dead deer found and submitted the data to us for analysis. We converted their data to a deer/mile index and compared it with previous winter loss indexes to decide if we needed to adjust any projected county estimates for excessive winter losses.

FINDINGS

WCOs provided usable reproductive data from 1,703 females examined during the 1999 prefawning season. The 1999 sample was 3% smaller than in 1998. Twenty-nine percent of the fawns, 87% of yearlings, and 91% of the adults were pregnant. Pregnant fawns averaged 1.30 embryos/doe, pregnant yearlings 1.74

embryos/doe, and pregnant adults 1.79 embryos/doe. The average reproductive rates for pregnant and barren fawns, yearlings, and adults were 0.37, 1.51, and 1.63 embryos/doe, respectively. The average reproductive rate for all females was 1.06 embryos/doe.

We estimated a 1999-2000 statewide winter density of 39 deer/mi² of forested habitat. This density was about 15% higher than the 1998-99 winter density ([Table 1](#)). The statewide winter deer population was 86% higher than the agency goal of 21 deer/mi².

Statewide, WCOs found 0.14 dead deer/mile on winter survey routes in 2000. In most counties, winter losses were well below the high losses recorded in 1978 ([Table 2](#)).

We projected a preseason state population of 1.523 million deer (59 deer/mi² of forest land) for the 2000 fall hunting season. This figure does not include counties with special regulations. Projected county densities (excluding counties with special regulations) ranged from lows of 26, 29, 34, 36, and 36 deer/mi² of forest land in the counties of Cameron, Clinton, Elk, Sullivan and Monroe, respectively, to highs of 123, 120, 115, 114, 113, and 113 deer/mi² of forest land in the counties of Washington, York, Berks, Greene, Lehigh, and Montour, respectively. The lowest projected rates of population increase from postseason 1999 to preseason 2000 was 32% in Elk County and 37% in Clinton, Cameron, Lycoming, and Sullivan counties. The highest projected rates of population increase were 63-67% in Washington, Greene, Erie, Lawrence, Beaver, Butler, Crawford, and Mercer counties ([Table 3](#)).

Several changes in deer management took place during the last fiscal year. The white-tailed deer species was split out of the Forest Wildlife Section and is now its own section, called the Deer Management Section. In August 1999, Gary Alt was re-assigned from the bear program to become supervisor of the Deer Management Section. This completes a complement of 3 full-time biologists to work on deer management.

These changes to deer management staff structure come at a time when deer populations continue to rise sharply. The recent increase to the statewide population resulted in an overwintering population (statewide) that is 86% above the average overwintering goal of 21 deer/forested square mile. This past year, over 1.0 million white-tailed deer overwintered in Pennsylvania.

The antlerless deer management program traditionally used in Pennsylvania has failed to adequately manage deer. The restriction of one antlerless license per hunter and reduced antlerless allocations has allowed populations to rise to a point where in many counties, we cannot even stop population growth. The traditional system requires an allocation that either cannot be sold, or that is not effective with the antlerless deer season time constraints. New regulations needed to be developed, and most importantly, need to be adopted by the commissioners to begin effectively managing deer.

Deer Management Section staff developed a plan to be implemented beginning with proposed regulation changes at the January commission meeting. The first phase of the plan is designed to increase the antlerless harvest to a level that will stop population growth, but still use only about the same number of antlerless licenses statewide (797,200 without special regulations counties) issued in 1998 and 1999. To accomplish this, we needed a system that increased the efficiency of the antlerless licenses.

Four major changes for deer management were proposed at the January commission meeting. Each change was designed to increase the efficiency of antlerless licenses. The proposed changes were: 1. An extension of the early flintlock season to be statewide; 2. Concurrent seasons for antlered and antlerless deer during the rifle season for junior and senior license holders; 3. Open antlerless season on the last day of the traditional buck season, making antlered deer and antlerless deer seasons concurrent on the final Saturday; 4. Allowing the harvest of multiple deer per hunter per day. A fifth change was proposed to extend the sale of a second antlerless license per hunter statewide (prior only southwest region counties could sell a second antlerless license per hunter.)

These recommendations were made and accepted by the commissioners at the January meeting. During the winter months, Supervisor Alt conducted a massive public relations campaign statewide to explain the impacts of deer on their habitat. During January-March, he conducted over 60 lectures, many of them for state government representatives, and many to state legislators to gather support for deer management that balances deer with their habitat. He was able to gather enough support to pass the recommendations made for deer management at the April commission meeting, making them official regulations for the 2000-01 deer hunting seasons. The only modification was a provision that the second antlerless license could only be used on private land.

We do not have good data from Pennsylvania to make estimates of the impacts each of the regulation changes will make to the harvest. No one knows how many additional flintlock hunters will be added because of the fall antlerless season. This number will influence the efficiency of antlerless licenses and could also influence the harvest in the post-Christmas flintlock deer season. We also do not know how much more efficient (i.e. additional antlerless deer that will be harvested) antlerless licenses will be removed from the rifle season because of previous success in the early flintlock season. We also do not know how successful junior and senior hunters in Pennsylvania will be on antlerless deer because of the change to concurrent seasons.

However, despite the uncertainties, some information was available to model possible impacts. We used information from Michigan (J. Urbain, pers. commun.) to estimate the impacts of junior-senior concurrent seasons, and we have limited information from the 1999 fall flintlock season in special regulations counties to estimate the impact of the flintlock season. The harvest needed to stabilize the population statewide is about 319,000 antlerless deer. The final approved antlerless allocation totaled 744,900 antlerless licenses in 61 nonspecial regulations counties. The allocation in the special regulations counties was 85,750. Even under the best circumstances, the antlerless harvest in 2000 will fall well short of the harvest needed to stabilize the overwintering herd.

One negative effect will occur to the buck population. We expect an increase in the harvest of bucks because the opening day of antlerless deer season is concurrent with the last day of the antlered deer season. We also expect that the efficiency of antlerless licenses will increase because more hunters can and will participate in an antlerless deer hunt that opens on a Saturday. The harvest rate on antlered deer is already too high, but we were willing to accept this consequence this year to increase the efficiency of the antlerless licenses.

Hunters and some commissioners may be pleased with the increases in deer abundance. However, we have

already been shown the lesson of rapid deer increases and deer overpopulation in Pennsylvania. If everyone with a stake in deer management knew the history of deer in the northcentral counties, they would understand why biologists stress the need to manage deer within the capacity of the land to sustain them over the long term. Unfortunately, the range damage inflicted decades ago in the northcentral and northeast counties has never been permitted to heal. It still cannot heal, and despite the more liberal regulations permitted for 2000, most county units will probably suffer additional increases to the overwintering population. The result can only be further damage to the deer range. Stakeholders who do not understand the deer-habitat relationship neglect the principles of deer management and deer biology, including deer reproduction and especially the impacts of deer to their environment. In recent years, populations in the southern half of the state have grown rapidly, and are being carried at levels far beyond what the forested land can support for long periods of time. And the same effects of overbrowsing and range deterioration by deer that we already experienced in the northcentral counties are being seen in the southern counties. We have already learned the lessons of carrying too many deer in the northcentral and northeastern parts of Pennsylvania. Our deer management program needs to address these problems before they occur in the southern half of the state, and to allow the range to recover across other parts of the state.

Because antlerless allocations have been restricted in recent years, statewide we are currently carrying 86% more deer than our Commission-approved goal. Pennsylvania is now carrying more deer than ever before. This fall, a projected 1.5 million deer will be available when the archery season opens in October. Because of the low antlerless allocation and restriction of surplus license sales in past years, and despite the liberalization of antlerless deer hunting opportunities in 2000, populations are so high in most counties that we cannot stop population growth. Once again, deer populations will increase in 2001. To stabilize or reduce populations toward Commission-approved goals, we will have to move to some alternative format with a longer rifle season for antlerless deer, and permit hunters to purchase antlerless licenses until allocations are sold out. The only other solution possible is a severe reduction in populations due to a harsh winter. If this were to occur, there would have to be mass starvation of deer and accompanying habitat degradation caused by starving deer. The real losers in the years following a catastrophic winter loss will be deer, other species of wildlife, habitat quality essential to all wildlife, and ultimately deer hunters. This surely is not a responsible way to manage Pennsylvania's deer and other wildlife resources.

The conversion from county-based Deer Management Units (DMUs) to the proposed deer managements (DMUs) was tabled until other more urgent issues in deer management can be settled. With two exceptions, we are currently obtaining all deer statistics for proposed DMUs that have been obtained for county-based units. The exceptions are success rates for antlerless deer hunters, and estimating populations. We will be working with BATS to create additional computer programming that will calculate success rates. Population estimates should be made using 7 years of data to do the modeling. Although some reduction in confidence is expected until 7 years of data are acquired, 5 years of DMU data are needed to mitigate variation from year to year in weather, food supply and distribution of hunter pressure. We need long term averages to overcome short-term fluctuations. We currently have DMU data for 1995-99 so we can begin to estimate populations. However, some issues regarding size and boundaries of the new DMUs need to be finalized.

RECOMMENDATIONS

Expanded opportunities in 2000 for antlerless deer should increase the efficiency of the antlerless licenses.

However, they will still not be sufficient to stop population growth in most counties. In Pennsylvania, deer management staff faces two antagonistic factors: An increasing deer population, and a declining hunter base to harvest deer. To increase the efficiency of the antlerless licenses, we recommend adding the following seasons:

1. A county specific, 3-day October gun hunt for antlerless deer that begins on a Thursday and ends on a Saturday.
2. A statewide, concurrent season for antlered and antlerless deer that follows the traditional antlered deer season time frame. A concurrent season would be beneficial in 2 ways: 1. It would increase the efficiency of antlerless permits; and 2. It would decrease the harvest rate of the bucks. Expanded hunting opportunities could also stimulate hunter interest in antlerless deer.

For antlerless deer licenses, we recommend that hunters be permitted to purchase and use all unsold licenses, and the removal of the restriction that second antlerless licenses be used only on private land. We also recommend that the Commission include the muzzleloader hunters in the antlerless license system.

LITERATURE CITED

Severinghaus, C. W. 1949. Tooth development and wear as criteria of age in white-tailed deer. J. Wildl. Manage. 13:195-216.

Table 1. County forest statistics, winter deer density goals, and estimated winter density trends from the winter of 1995-96 through the winter of 1999-2000 for Pennsylvania. Special regulations counties are excluded.

County	Mi ² of forested land					Winter deer density estimates					
	% Forest	Seedling sapling	Pole timber	Saw timber	Total	Goal ^b	95-96	96-97	97-98	98-99	99-00
Adams	33	33	41	99	173	24	41	40	50	58	58
Armstrong	54	98	43	214	355	29	37	45	44	52	55
Beaver	48	33	60	117	210	22	36	34	39	36	47
Bedford	72	172	212	342	726	25	32	30	31	29	34

Berks	35	40	85	175	300	21	41	56	49	60	71
Blair	64	59	113	166	338	22	40	36	41	40	42
Bradford	59	127	269	280	676	22	28	31	37	42	45
Butler	50	75	110	212	397	23	33	42	42	47	56
Cambria	64	52	116	271	439	21	28	28	29	33	32
Cameron	94	20	86	266	372	19	17	19	15	15	19
Carbon	75	67	114	105	286	23	33	32	21	27	29
Centre	76	104	304	429	837	20	26	27	27	29	31
Clarion	61	91	85	194	370	26	28	41	42	41	45
Clearfield	74	145	305	398	848	21	39	37	33	37	38
Clinton	87	33	275	464	772	16	17	18	18	18	21
Columbia	53	29	102	126	257	19	35	34	39	46	54
Crawford	48	42	158	285	485	18	31	35	33	39	46
Cumberland	35	17	87	90	194	17	32	27	34	37	49
Dauphin	50	51	85	129	265	23	22	22	20	27	32
Elk	91	64	137	552	753	21	29	23	21	24	26
Erie	47	100	49	224	373	29	33	30	30	36	40
Fayette	61	74	114	292	480	23	26	28	26	33	33
Forest	93	50	43	304	397	23	33	29	32	39	43
Franklin	44	77	40	219	336	27	36	45	34	34	38

Fulton	69	34	91	177	302	20	30	31	30	30	35
Greene	56	44	111	169	324	20	50	45	50	59	69
Huntingdon	75	94	210	353	657	21	33	36	39	40	42
Indiana	61	100	160	243	503	23	32	36	33	39	40
Jefferson	61	21	74	308	403	19	36	42	39	37	37
Juniata	66	18	80	161	259	18	31	37	29	34	32
Lackawanna	68	59	105	147	311	23	34	30	23	32	32
Lancaster	13	0	11	114	125	19	29	48	49	57	69
Lawrence	42	24	43	84	151	22	17	21	23	28	29
Lebanon	34	18	26	78	122	23	26	26	31	38	44
Lehigh	29	12	20	68	100	22	39	52	52	66	70
Luzerne	66	60	273	253	586	17	30	29	26	33	40
Lycoming	77	85	310	559	954	19	29	27	23	24	29
McKean	81	90	237	485	812	20	26	26	25	30	35
Mercer	39	35	62	166	263	22	36	35	37	40	46
Mifflin	72	35	56	205	296	22	25	27	29	32	31
Monroe	76	38	178	245	461	18	24	25	17	22	25
Montour	27	9	0	27	36	30	50	57	55	72	72
Northampton	34	29	18	80	127	27	30	39	47	51	64
Northumberland	50	45	78	105	228	23	22	26	23	26	29

Perry	64	10	92	253	355	17	34	38	30	37	42
Pike	82	42	149	260	451	19	23	27	20	22	28
Potter	86	73	202	652	927	20	19	23	24	31	36
Schuylkill	71	110	295	146	551	20	26	31	34	37	38
Snyder	51	18	76	75	169	18	26	30	31	33	37
Somerset	64	157	238	294	689	24	30	29	29	29	33
Sullivan	86	18	139	230	387	16	23	23	20	27	26
Susquehanna	65	114	134	283	531	25	36	45	34	37	36
Tioga	66	103	305	352	760	19	27	31	30	38	40
Union	68	6	79	129	214	16	26	27	27	26	31
Venango	72	26	111	348	485	19	23	36	25	34	40
Warren	79	62	109	527	698	21	27	30	30	31	34
Washington	50	132	113	182	427	28	46	50	49	67	74
Wayne	66	54	154	272	480	20	39	39	30	38	45
Westmoreland	51	137	98	283	518	28	41	40	39	48	48
Wyoming	62	47	82	118	247	23	29	34	31	30	34
York	27	9	55	180	244	18	52	48	51	69	75
Total	59	3,738	7,740	15,051	26,529	21	30	31	30	34	39

^aForest statistics are based on 1989 U.S. Forest Service inventory data for Pennsylvania.

^bGoals are based on 60 deer/mi², 5 deer/mi², and 20 deer/mi² for seedling/sapling, pole, and sawtimber stands, respectively.

Table 2. Dead deer found on winter survey routes in 2000 and dead deer found/mile surveyed in 2000 and 1978 in Pennsylvania.

County	2000		Dead deer/mile	
	Miles	Dead deer	2000	1978
Adams	10.00	3	0.30	0.33
Allegheny	11.00	7	0.64	0.15
Armstrong	8.70	0	0.00	0.11
Beaver	7.25	1	0.14	0.00
Bedford	16.00	3	0.19	1.35
Berks	15.10	2	0.13	0.00
Blair	14.50	3	0.21	4.00
Bradford	20.50	7	0.34	0.81
Bucks	9.50	6	0.63	
Butler	11.00	2	0.18	0.09
Cambria	9.70	0	0.00	2.18
Cameron	4.50	0	0.00	13.60
Carbon	15.00	4	0.27	0.13
Centre	19.10	0	0.00	3.35
Chester	9.50	7	0.74	0.00

Clarion	10.00	0	0.00	1.88
Clearfield	14.50	2	0.14	5.17
Clinton	11.00	0	0.00	0.87
Columbia	11.75	3	0.26	0.83
Crawford	27.50	0	0.00	0.33
Cumberland	9.50	1	0.11	0.55
Dauphin	10.25	0	0.00	1.67
Delaware	1.50	0	0.00	
Elk	9.65	2	0.21	1.86
Erie	15.70	0	0.00	0.08
Fayette	12.00	2	0.17	0.00
Forest	11.50	1	0.09	0.42
Franklin	11.10	2	0.18	0.29
Fulton	4.40	1	0.23	0.75
Greene	9.00	2	0.22	0.83
Huntingdon	15.60	6	0.38	0.95
Indiana	11.00	0	0.00	2.16
Jefferson	11.10	4	0.36	1.00
Juniata	5.80	0	0.00	2.67
Lackawanna	11.20	0	0.00	2.24

Lancaster	17.90	3	0.17	0.00
Lawrence	9.30	0	0.00	0.33
Lebanon	6.00	0	0.00	
Lehigh	6.75	0	0.00	0.00
Luzerne	15.00	0	0.00	0.78
Lycoming	25.80	8	0.31	0.70
McKean	15.70	4	0.25	1.23
Mercer	9.50	0	0.00	0.00
Mifflin	6.50	0	0.00	0.77
Monroe	9.50	0	0.00	4.10
Montgomery	10.00	0	0.00	0.14
Montour	4.50	0	0.00	0.00
Northampton	5.90	2	0.34	
Northumberland	4.50	0	0.00	1.67
Perry	9.70	1	0.10	1.01
Philadelphia	5.50	1	0.18	
Pike	9.00	0	0.00	4.33
Potter	21.60	4	0.19	3.69
Schuylkill	10.50	2	0.19	0.74
Snyder	5.30	0	0.00	0.63

Somerset	18.75	6	0.32	3.93
Sullivan	4.50	1	0.22	0.75
Susquehanna	9.10	0	0.00	3.97
Tioga	29.50	0	0.00	4.17
Union	7.50	1	0.13	1.09
Venango	10.50	0	0.00	0.38
Warren	19.50	1	0.05	2.10
Washington	10.25	1	0.10	0.29
Wayne	11.50	3	0.26	16.42
Westmoreland	15.50	0	0.00	3.03
Wyoming	4.50	0	0.00	0.00
York	22.00	0	0.00	
2000 Totals	776.95	109	0.14	
1978 Totals	686.05	1,330		1.94

Table 3. County deer population densities (deer/mi² of forest land) and projected rates of population increase from postseason 1999 to preseason 2000. Special regulations counties are not included.

	1999 deer densities		2000 projected preseason density	% Population increase
	Preseason	Postseason		
Adams	76	58	93	60

Armstrong	80	55	89	61
Beaver	68	47	77	63
Bedford	48	34	53	53
Berks	98	71	115	62
Blair	54	42	62	49
Bradford	63	45	72	61
Butler	79	56	92	63
Cambria	46	32	49	52
Cameron	23	19	26	37
Carbon	38	29	42	42
Centre	41	31	44	43
Clarion	61	45	71	59
Clearfield	52	38	55	44
Clinton	27	21	29	37
Columbia	72	54	84	57
Crawford	66	46	75	63
Cumberland	65	49	78	60
Dauphin	44	32	49	55
Elk	33	26	34	32
Erie	57	40	65	64

Fayette	45	33	51	53
Forest	57	43	66	54
Franklin	50	38	55	44
Fulton	47	35	53	53
Greene	96	69	114	66
Huntingdon	55	42	62	48
Indiana	61	40	64	60
Jefferson	54	37	58	58
Juniata	43	32	48	49
Lackawanna	42	32	46	42
Lancaster	94	69	111	61
Lawrence	42	29	47	63
Lebanon	60	44	68	55
Lehigh	94	70	113	62
Luzerne	51	40	56	42
Lycoming	36	29	39	37
Mckean	44	35	52	52
Mercer	69	46	76	63
Mifflin	41	31	45	43
Monroe	32	25	36	43

Montour	99	72	113	57
Northampton	85	64	104	62
Northumberland	41	29	46	57
Perry	57	42	65	54
Pike	36	28	40	43
Potter	45	36	52	44
Schuylkill	52	38	57	52
Snyder	49	37	55	49
Somerset	46	33	50	52
Sullivan	34	26	36	37
Susquehanna	50	36	53	45
Tioga	52	40	58	46
Union	42	31	46	48
Venango	56	40	64	59
Warren	47	34	54	56
Washington	100	74	123	67
Wayne	57	45	64	42
Westmoreland	70	48	77	60
Wyoming	48	34	50	45
York	102	75	120	60

Totals	53	39	59	52
--------	----	----	----	----
