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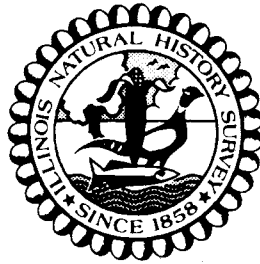
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ILLINOIS NATURAL HISTORY SURVEY



Section of Wildlife Research

Performance Report

Annual Job Progress Report

Illinois Forest Game Investigations

W-87-R-9

1 July 1987 through 30 June 1988

by

Charles M. Nixon



15 August 1988

Performance Report
Annual Job Progress Report

State: Illinois

Project No.: W-87-R-9

Project Type: Research

Sub-project VII: Illinois Deer Investigations

Period Covered: 1 July 1987 through 30 June 1988

This performance report covers reports of progress for the jobs active under the R-9 segment.

Study No. VII-D; Title: Harvest Strategies for Illinois Deer Herds.

Study Objectives:

1. To continue to analyze the annual status and harvest of deer on a county and regional basis, to evaluate hunter demands for hunting permits in terms of hunter satisfaction and to maximize harvest from predictive models on deer population dynamics, and to simulate alternative harvest strategies that build and ultimately maintain future deer herds at appropriate regional and local scales at levels compatible with current and projected land use.
2. To develop population goals for county and regional deer herds based on a determination of landowner tolerance, projected demands for hunting recreation, and land use trends.
3. To summarize the data collected during the 5-year Allerton Study and develop a comprehensive perspective of deer population dynamics, seasonal movements, and landscape utilization in central and northern Illinois essential to

foundation concepts for simulation modeling as a basis for deer herd modeling.

4. To develop management strategies for the location, protection, and development of a system of secure wintering sites for deer in the 47 counties of central and northern Illinois where winter protection is essential for maintaining huntable deer populations.
5. To prepare technical reports and give management seminars for agencies managing deer in Illinois, and also to prepare scientific papers for submission to professional journals.

Job No. VII-D-1; Title: Population dynamics of the Illinois deer herd--current status, harvest analysis, and formulation of alternate management strategies.

Objectives: To develop specific deer population goals for counties and regions, to continue to analyze the annual status and harvest of deer, to evaluate requests for hunting permits, and to develop alternative harvesting regulations that balance hunter satisfaction with deer population dynamics.

(a) Activity:

1987 Harvest

Deer harvests and hunter success rates for 1986 were entered into existing computerized data bases and analyzed using programs developed for this project. (See progress reports for W-87-R-6 and 7 for descriptions of these programs.) Updated estimates of the 1986 deer harvest and

programs to provide harvest breakdowns by county, region, and statewide were provided to the Illinois Department of Conservation.

For 1987, 100,069 hunters harvested a reported 42,932 deer, another record harvest for Illinois. The fawn harvest was somewhat higher and the harvest of older deer somewhat lower in 1987 compared with 1986 (Table 1). The age structure and sex ratios of harvested deer in 1987 were typical of recent harvests in Illinois, with males exceeding females in each age class up to 4 years (Table 1).

A total of 58,575 archers killed an estimated 10,461 deer, of which 70% were males and 70% of the males were 1 year or older (J. Kube, Ill. Dept. Cons., personal comm.). The adjusted total kill including crippling loss and non-reported kills (30% of shotgun kill and 40% of archery kill based on recoveries of marked deer in Platt County, Illinois) is estimated to total 70,457 deer for 1987 (14,645 killed by archers and 55,812 killed by shotgun hunters). If this kill represents between 30% and 40% of the prehunt population as seems a reasonable assumption based on reported harvests in the Midwest (Nixon 1970 and 1984 and 1985 harvests from a 2,353-ha site in Platt County, Illinois), the estimated prehunt abundance would total between 176,000 (40% harvest) and 234,000 (30%) deer in Illinois for 1987. With a little more than 4 million acres of inhabitable range in Illinois (Hahn 1987), this area of range would provide a prehunt estimated average density of 1 deer to 17-23 acres of wooded or marsh-prairie habitat.

Modeling the Illinois Deer Herd

Simulation modeling provides a means of determining the probable history of changes in deer numbers during the immediate past and present and provides a means of projecting the future direction of change--based on the assumption that the upper and lower limits (e.g., a reasonable range of values) for natality and mortality, are known or can be inferred with reasonable accuracy. Unfortunately, good estimates of natality and, particularly, mortality are not readily available for deer in Illinois, or for that matter, throughout the Midwest Agricultural Region. In Illinois, such data are only available from local studies of marked deer in eastcentral Illinois (C. Nixon, unpublished data) and for deer on the Crab Orchard National Wildlife Refuge in southern Illinois (Nelson and Woolf 1986, Roseberry and Klimstra 1970, 1974). These two data sets were used as initial starting points for estimating natality and seasonal mortality. The initial values were then modified as necessary to obtain reasonable simulations of deer numbers in Illinois (Table 2).

Sixteen counties, 2 each from the 8 deer regions used in Illinois were selected as typical of counties in each region. Through repeated trial and error, I simulated preseason, postseason, and spring deer numbers for each county for 1980 through 1987. The computer model, a general situation population model, was written by Dr. L. Hansen

(unpublished data). It allows input of either numbers of deer harvested or proportions killed. A diagrammatic outline of the input values necessary to run this model and the data generated by it are shown in Figure 1. Because of differences in age structure and natality between deer on the Crab Orchard Refuge and those in central and northern Illinois, the age structure and natality rates used in Deer Regions 1-7 were those derived from Platt County deer; for deer in Region 8 (Union and Saline counties), I used data from Crab Orchard Refuge. In all cases, initial population sizes were determined by trial and error and were simply the number of deer necessary to provide reasonable numbers of deer to support the known (harvest) and estimated (non-hunting) mortality under the specified rates of natality.

Because county deer harvests are dependent upon both numbers of deer and numbers of hunters, known deer harvests were standardized for a given number of hunters, in this case the number who hunted in 1980. The number of hunters in 1980 was subtracted from the hunters in each succeeding year and the result multiplied by the hunter success for that year. This number was then subtracted from the kill for that year to produce the deer kill for what would have been a standard number of hunters (the number that hunted in 1980). These adjusted harvests were used to determine the rate of increase (%) in the harvest for the 8 years, 1980-87. The simulated population was manipulated until

population trends closely mimicked changes in the adjusted harvests while still providing sufficient deer to achieve the harvests estimated for 1986 and 1987.

The results of these simulations are shown in Table 3. It was concluded that the estimated initial deer numbers derived from an earlier simulation (see Nixon and Hansen 1986: Table 18) were too low in every county to support the harvests of antlered males in 1985-87. The earlier estimates were then increased an average of 31.5% (range 17.7-59.2%) in order to produce numbers of deer that could support recent known mortality and harvest rates.

Findings from simulations indicate hunters have harvested antlered males at considerably higher rates than fawns or females. Marked antlered males were known to have been killed at significantly higher rates than yearling and older females in Platt County during 1980-85, and kills of antlered males are usually reported as exceeding kills of yearling and older females in "any deer" harvests (Severinghaus and Cheatum 1956). High rates of harvest of antlered males were relatively consistent among counties, although the projected rates of increase based on a standard number of hunters varied considerably among counties (Table 3).

The estimated total number of deer harvested was often less than 30% of the estimated prehunt population. Harvests of more than 30% are considered necessary to stabilize deer numbers. The increasing numbers of deer in all Illinois

counties during the 1980's were reflected in hunter success rates and numbers of deer killed on the highway (not corrected for changes in highway travel between 1980 and 1987). Numbers of deer killed on highways increased at even higher rates than reported harvests (Table 4).

The findings to date provide some tentative conclusions relative to managing the deer harvest in Illinois:

(1) Fawns are generally under represented in the harvest because of hunter preference for larger deer, particularly antlered bucks.

(2) Antlered males are being exploited at fairly high levels under the current hunting regulations, largely because hunters prefer antlered males and the positioning of the shotgun season near the peak of breeding activity.

(3) Yearling and older females are also under represented in the shotgun harvest because of hunter preference and the higher proportion of females that remain within refugia. Wider ranging males of breeding age, however, are less well protected as they move over large home ranges that include hunted areas (Murphy 1961, Piatt County, Illinois, unpublished data).

(4) Yearling males are quite vulnerable to hunting because they too roam extensively over large ranges, are frequently harassed by older males, and are often forced from refugia onto heavily hunted areas (Roseberry & Klimstra 1974, unpublished Piatt County data).

(5) Deer numbers in Illinois counties increased between 1980 and 1987, largely because the female segment of the herd was underharvested. If the goal of deer management is to stabilize deer numbers, then more females must be killed. The steady increase in "any deer" permits has been paralleled by increasing deer numbers because an increased proportion of the hunters now hunt antlered deer and avoid fawns and females.

(6) Mortality of fawns between birth and weaning at about 4 months of age must be <15% over much of the state (except Region 8). This conclusion is based on the finding that using higher rates of fawn mortality quickly exhaust the yearling male and older male segments of the population in simulated deer herds.

(7) If the above conclusions are in error, it is likely they err on the low side, e.g., that more deer were actually present in 1980 than were indicated in the simulations. If so, estimated harvests of females must have been even lower than those indicated in Table 3, and more deer present would reduce the high rate of harvest for antlered males.

(8) Simulations indicate that deer herds in each county are unique, and that estimated deer hunters, hunting pressures, and harvests are not readily transferable among counties. This lack of the ability to transfer simulations among counties is likely the result of differing rates of hunting pressures applied when deer numbers were at

different levels (Table 3). The differing rates of hunting pressure and different levels of deer numbers result in differing rates of population changes over time. These differing rates of populations change suggest that if deer are to be managed, and results sold on a county basis, simulations of deer demographics are desirable for each of the 98 Illinois counties open to shotgun deer hunting.

Future Populations and Harvests

It is useful to project deer numbers ahead at least as far as 1988 and 1989 to estimate the impact of present hunting pressure and harvests on the dynamics of deer abundance. In each of the 16 selected counties, deer numbers were simulated for 1987 by the use of the same data used for the 1980-87 simulations. For 1988 and 1989, proportionate harvest levels for each sex and age class were derived as the average of 1984-87 harvest levels and were based on simulated prehunt estimates. The simulated numbers for 1988 and 1989 were then compared with the 1987 simulated number to see how abundance might change if mortality rates remained unchanged. If simulated deer numbers continued to increase, the simulated harvest levels were then increased to achieve stability of abundance.

The number of females which must be harvested to achieve zero increase in deer numbers was then averaged for 1988 and 1989, and divided by the average hunter success rate for yearling and older females for 1985-87 to produce

an estimate of the number of "any deer" permits that would be required to stabilize deer numbers. As shown in Table 5, harvests of females need be increased up to 40% of the prehunt population in some counties to achieve a numerically stable deer herd. However, differences among counties were large, likely due to errors in the simulation model (numbers generated too high or low), differences in mortality rates (poaching may be highly variable among counties), and already heavy hunting pressures in some counties. In the 16 counties, it now appears that no change in permit numbers is projected for 1 county, too many permits are currently issued in 4 counties, and permits could be increased in 11 counties (Table 5), if population stability is the management goal in these counties.

Population Goals

As reported in the R-8 annual report, farmer preferences for deer densities on their farms as indicated by the 1982 landowner questionnaire survey, indicated that most farmers were reasonably satisfied with current deer densities. Nearly 1/4 of those landowners questioned were willing to tolerate more deer. Well over half the remaining farmers were satisfied with the existing numbers of deer. Only in Deer Regions 3 and 4 did more farmers indicate a preference for either stable numbers or fewer deer than those who wished for an increase in deer (Kube 1983). Deer numbers have increased statewide since 1982 and there is a

need for current information on landowner attitudes on deer abundance.

In 1987, the Illinois Department of Agriculture in cooperation with the Department of Conservation and Commerce and Community Affairs conducted a questionnaire survey regarding the recreational use of privately owned lands in Illinois. Three questions dealt specifically with deer numbers and landowner perceptions of current deer damage. The low response (51% of 1,197 individuals questioned) precluded use of the results to set county or regional goals (Stoll and Mountz 1983, Brown and Decker 1979). The responses provide a general indication of regional landowner tolerance for deer in 1987.

As might be expected, landowners in regions with the most deer and highest frequency of crop damage were most likely to prefer stable numbers or fewer deer (Table 6). Reported damage was highest in Deer Regions 3, 4, and 6. These same regions contained the highest proportion of landowners wishing for fewer deer. The small sample for Region 7 may account for the contradictory reports of fairly high crop damage and yet a preference for stable or increasing numbers of deer. Statewide, deer were present on 81% of the farms and caused damage on about 26% of these farms. In Deer Region 3 where reported damage was highest, deer reportedly caused damage on 31.7% of the farms where they were present (92% of all farms) in 1987.

A comparison of damage complaints in 1982 with 1987 indicates that the increasing harvests of deer have reduced the incidence and severity of crop damage throughout the state (Table 6). However, such a comparison is based on the subjective judgement of landowners and was developed from 2 different questionnaires administered by 2 separate agencies (landowners may respond differently to questions from the departments of Agriculture and Conservation). Thus, the results of the two surveys are not strictly comparable. The conclusion that may be valid is the landowner perception that deer are not currently (1987) causing excessively high levels of damage to crops, and that damage has apparently not increased since 1982. If true, these conclusions indicate that recent harvests may have kept pace with recent changes in deer abundance. As noted above, simulation modeling of deer numbers suggests that harvests are still lagging behind annual increases in deer numbers in many counties.

(b) Target Date of Achievement: 1 September 1989.

(c) Date of Accomplishment: Same.

(d) Significant Deviations: None.

(e) Remarks: None.

(f) Recommendations:

(1) Differences in current deer numbers and harvest levels among counties (Tables 4 and 5) mean the IDOC should continue to manage deer on a county basis and not on a regional basis. Check stations should continue to be

operated in each county to register the shotgun harvest. However, with an accurate kill registration on a county basis, sex and age data could be gathered at a smaller number of check stations and the results applied to all counties in the Region. However, accurate registration of the kill, even if sex and age data are not collected, is not without some cost, particularly if personnel are paid to operate every check station throughout the deer hunting season. Some states operate check stations without payment, with merchants who volunteer to check deer in anticipation of increased business from deer hunters.

(2) The statewide archery kill has reached a level where compulsory checking and tagging of kills are desirable. In a few counties, the archery kill now nearly equals that of the shotgun harvest. Nearly 40% of the 1987 archery kill was not reported to the IDOC as required by law (J. Kube, IDOC personal comm.).

(3) There is a need for an estimate of the deer killed by shotgun hunters that are not checked at a check station each year. I have used an arbitrary figure of <5% unreported kills for use in the deer simulation model. The magnitude of the unreported but otherwise legal kill remains a mystery. Information gathered by law enforcement personnel at road blocks etc. where hunters are encountered at random could provide some quantitative data if such were legal and if law enforcement personnel would record such data.

(4) Only mortality rates gathered from deer marked in eastcentral Illinois (Platt County) during 1980-85 are currently available for use in simulation modeling of Illinois deer. Based on the results from the 16 counties that have been examined to date, these rates do not "fit" deer herds as they occur over large portions of the state. Modeling is a powerful tool, but simulations are only as good as the information that goes into the models. Models need good initial estimates of deer numbers and reasonable estimates of natality and mortality to mimic regional changes in deer numbers. For example, deer harvests and populations are highest in Deer Region 4, westcentral Illinois, yet there are no demographic data available for deer in this area except those provided by the annual harvest from check stations.

For fawns from birth to about 4 months old (June-September), survival can be calculated using fetal rates estimated from females killed on highways between January and May and fawn:doe counts made by spotlight in late summer and early fall. For deer older than 1 year, however, estimates of seasonal and annual survival require marked samples of deer obtained by livetrapping and tagging. I believe a livetrapping and marking program should be undertaken in 3 of the 6 Deer Regions (1, 4, and 7) where seasonal and annual mortality rates are unknown at present (some data are available from marked deer in Regions 5 and 8).

(5) There is a need for additional indices to annual changes in regional deer numbers. At present, only harvest results are readily available in late spring when county permit allocations are made each year. Thus, harvests tend to track past histories, not present conditions, and lag behind current herd status. Overharvests may be masked by high kills and good hunting success for 1-2 years. I believe the first quarter (January-March) highway kill may provide a useful index to herd status on a regional basis, if corrections for rates of highway travel are used to standardize traffic flow. High correlations between highway kills and harvests have been demonstrated for other Midwestern states (McCaffery 1973, Nixon 1965). Another index to current deer abundance could be developed from archery hunter deer observations where volunteers keep records of all deer seen in relation to hours hunted.

(6) Finally I suggest that the IDOC develop an additional hunting permit, one that requires the hunter to kill only an antlerless deer. I foresee 2 situations that require such a permit: (a) On wildlife refuges that are opened to hunting on a restricted basis in response to excessive deer damage to crops etc. and where the aim is to reduce local deer numbers as quickly as possible using a limited number of hunters, and (b) For use in counties where hunter access to deer is restricted because of limitations placed on the numbers of hunters by owners of private land. For example, the most productive deer hunting in Piatt

County occurs on a few farms close to the Allerton Refuge. Hunting privileges are tightly controlled on these farms and issuance of additional county permits to increase the kill will not always ensure that additional hunting pressure will result. In this case allowing those hunters with existing hunting rights to take an additional deer, which would have to be antlerless, would provide a means of increasing the local deer harvest wherever an increase becomes necessary.

(g) Cost: Federal - \$18,367; State - \$6,122; Total - \$24,489

Literature Cited

- Brown, T. and D. Decker. 1979. Incorporating farmers' attitudes into management of white-tailed deer in New York. *J. Wildl. Manage.* 43:236-239.
- Hahn, J.T. 1987. Illinois forest statistics, 1985. U.S.D.A. Forest Service. Resource Bull. NC-103. 100pp.
- Kube, J. 1983. Assessment of deer management by Illinois landowners. Population studies of white-tailed deer. Study 2. Ill. Perf. Rep. Pittman-Robertson Proj. W-87-R-26. 9pp.
- McCaffery, K.R. 1973. Road kills show trends in Wisconsin deer populations. *J. Wildl. Manage.* 37:212-216.
- Murphy, D. 1961. Deer harvests from refuge areas in Missouri. *Proc. SE Assoc. Game & Fish Comm.* 15:37-42.
- Nelson, T.A. and A. Woolf. 1987. Mortality of white-tailed deer fawns in southern Illinois. *J. Wildl. Manage.* 51:326-329.
- Nixon, C. 1965. The relationship between the annual accidental kill and the legal harvest in Ohio 3:123-136.

- _____. 1970. Deer populations in the Midwest. Pp. 11-18. In
U.S.D.A. Forest Service 1970. White-tailed deer in the Midwest. N.
Cent. Forest Exp. Sta., St. Paul, Minn. 34pp.
- _____ and L. Hansen. 1986. Illinois deer investigation. III. Perf. Rep.
Pittman-Robertson Proj. W-87-R-7. 56pp.
- Roseberry, J. and W. Klimstra. 1970. Productivity of white-tailed deer on
Crab Orchard National Wildlife Refuge. J. Wildl. Manage. 34:23-28.
- _____ and _____. 1974. Differential vulnerability during a controlled
deer harvest. J. Wildl. Manage. 38:499-507.
- Severinghaus, C.W. and E. Cheatum. 1956. Life and times of the
white-tailed deer. Pp. 57-186. In W.P. Tayler, Ed. The deer of
North America. Stackpole Co., Harrisburg, PA. 668pp.
- Stoll, R., Jr. and G. Mountz. 1983. Rural landowner attitudes toward deer
and deer populations in Ohio. Ohio Dept. Fish and Wildl. Rept. 10.
Ohio Dept. Nat. Resources, Columbus. 18pp.

Job No.: 11-D-2; Title: Life history and ecology of farmland deer.

Objectives: To summarize the data collected during the 5-year

Allerton study and to develop a comprehensive perspective of individual behavior, local and regional deer population dynamics, seasonal movements, and landscape utilization that provides the essential basis to develop improved strategies for managing deer in central Illinois.

(a) Activity:

A first draft of the final report for this job has been written and is now being reviewed by the 4 coauthors. An abstract of the important findings is presented in Appendix 1.

(b) Target Date of Achievement: 1 September 1989.

(c) Date of Accomplishment: Same.

(d) Significant Deviations: None.

(e) Remarks: None.

(f) Recommendations: None.

(g) Cost: Federal - \$18,367; State - \$6,122; Total - \$24,489

Job No. VII-D-3; Title: Strategies for developing and managing systems of secure wintering sites for deer in central and northern Illinois.

Objectives: To develop strategies for locating, protecting, developing, and managing systems of secure wintering sites for deer in central and northern Illinois.

(a) Activity:

Present Status of Deer on Wintering Sites under Public Ownership

All wintering sites with at least some public ownership were examined to determine the status of deer on these areas, the extent of crop damage on farms surrounding these lands, and the harvests of deer by hunters from these public lands. These data are summarized in Table 7 and indicate: (1) Hunting has been conservatively used to control deer numbers on sites in public ownership, and more areas have been hunted each year as deer numbers increased over time; (2) In winter 1988, deer were present in excessive numbers on a number of State Parks--Castle Rock (Ogle Co.), Chain O'Lakes (McHenry Co.), Lake-Le-Aqua-Na (Stephenson Co.), Rock Cut (Winnebago Co.), Morrison-Rockwood (Whiteside Co.), Shabbona Lake (DeKalb Co.), Goose Lake Prairie (Grundy Co.), and Jubilee College (Peoria Co.). Most of these parks have been hunted under a system of issuing a limited number of permits for shotgun hunting; however, deer are still increasing on these sites; (3) Deer are also a

problem on public lands such as State Conservation Areas (Marseilles, LaSalle Co.), county forest preserves (Severson, Winnebago Co.; Russel, Dekalb Co.; Sauk, Will Co.; Salt Fork, Champaign Co.; and the Vermilion County forest preserves), and on State Nature Preserves (Castle Rock, Ogle Co.; Sand Prairie-Scrub oak, Mason Co.) that are closed to hunting. The Joliet arsenal also has an overabundance of deer at the present time.

Sites with an overabundance of deer annually contribute deer to the surrounding areas through dispersals and seasonal migrations. Areas where deer are hunted to near extinction in the fall are typically restocked each spring by deer that move away from wintering sites. Habitats not favored for winter cover are vacated by deer each fall as deer move to traditionally used wintering sites. These sites are usually restocked each spring as deer retrace their fall movements. The management problem becomes one of controlling deer numbers on total or partial refuges while still providing ample numbers to restock vacant habitats the following spring.

Effective Stocking Distance

It is not surprising that hunters tend to hunt close to public and private refuges. Deer are abundant and antlered males, at least, often move away from even the largest refuges in Illinois in search of females in breeding condition. Thus, use of deer kill locations to determine

the effective distance from a wintering site, which dispersing deer would be expected to restock, may not be possible. For example, an average of 28 ± 3.7 deer were reported killed within 2 km of 49 wintering sites over 8 years compared with an average of 18 ± 2.3 deer killed 2-4 km from the same wintering sites over the same 8 years, a significant difference ($P < 0.05$). A major problem is that deer killed at distances greater than 4 km from a known wintering site were difficult to assign to a particular wintering site. Even deer killed within 4 km of a wintering site could have moved from a more distant wintering site.

Another approach to the problem of determining effective stocking distance from wintering sites was attempted using stocking frequencies in relation to distance moved for marked deer from a single refuge. Marked deer were located on 37 different areas after dispersing from a refuge in Platt County, Illinois. The regression of number of deer dispersing to a particular site on the distance of the site from the refuge was significant ($r = -.372$, $P < 0.05$). Use of the regression equation $Y = .7082 + (-.0062)X$ to determine annual stocking probabilities in relation to distance from refuge indicated a site 10 km away would receive 63% more deer (.65/year) than a site 50 km away (.40 deer/year).

Dispersion of Present Deer Wintering Sites

Dispersion of sites where deer are known to winter in each Illinois county was determined using 3 procedures, the

average distance between sites (km), the number and proportion of all townships containing 1 or more wintering sites, and the average number of sites per township with at least 1 site present. Sites were most abundant in Deer Region 3 (westcentral), and least abundant in Region 5 (eastcentral). This distribution is a reflection of the relative availability of suitable upland cover (Table 8). Fewer than half of the townships in the 46 counties examined contained at least 1 secure traditionally-used wintering area. Of course some townships are largely urban or agricultural and offer little available cover for deer. In some counties, forests are restricted to flood-prone river and stream bottoms, and are largely avoided by deer in winter (Nixon et al. 1988). Sites tended to cluster because forests were aggregated along waterways in most counties. It is apparent that secure wintering sites are not available throughout each county. It is still not clear (1) if additional wintering sites are needed and (2) if the present dispersion of wintering sites provides deer sufficient to adequately stock all existing summer habitats. Even if new sites could be created, either by state purchase or leasing or by simply designating sites as refuges on private lands (with owner consent), I suspect justification for creation or additional deer refuges would need to be very biologically compelling, in light of the present robust nature of the statewide deer herd. Existing refuges have certainly played a substantial role in the deer herd

buildup, particularly in the eastcentral and northeastern counties where limited forest cover can be easily shot out each year. Perhaps a system of "moving" refuges offers the best compromise, with refuge designation limited to a certain time--long enough to provide a dispersing component yet short enough that deer do not become a local nuisance. Older refuges would be eliminated and new ones created nearby. This idea is certainly not new as creation of wildlife refuges was important in deer restoration in many states.

Habitat Conditions

Regional summaries of habitat conditions within 10.36-km² blocks centered within each wintering area are shown in Table 9. Sites in Region 1 had less cropland and more pastured forest than sites further south. Sites in Region 2 had less total forest, less young forest (<50 years), and less open forest canopy than sites in other regions. Sites in Regions 3 and 4 were on rougher topography than sites to the east and north and sites in Region 5 had a higher proportion of young, disturbed forest cover than sites in other Regions (Table 9). Sites averaged between 200 and 300 ha of forest and contained considerably more upland than bottomland forest--a reflection of avoidance of these flood prone habitats. High speed highways were uncommon in or close to wintering sites but houses were fairly abundant--wintering sites were not wilderness in character,

but human activities tended to be aggregated within wintering sites and thus afforded deer considerable diurnal protection from human disturbances.

- (b) Target Date of Achievement: 1 September 1989.
- (c) Date of Accomplishment: Same.
- (d) Significant Deviations: None.
- (e) Remarks: None.
- (f) Recommendations: None.
- (g) Cost: Federal - \$16,463; State - \$5,488; Total - \$21,951

Literature Cited

Nixon, C., L. Hansen, and P. Brewer. 1988. Characteristics of winter habitats used by deer in Illinois. *J. Wildl. Manage.* 52:552-555.

Job No. VII-D-4; Title: Data analysis and preparation of manuscripts and reports.

Objective: To prepare manuscripts and reports from the results of project study investigations and to help defer the cost of printing these reports.

(a) Activity:

One manuscript was published during this segment:
Nixon, C., L. Hansen, and P. Brewer. 1988. Characteristics of winter habitats used by deer in Illinois. J. Wildl. Manage. 52:552-555.

The abstract for this paper is appended as Appendix 2.

The first draft of the final report for Job VII-D-2 was written and is being reviewed. Two oral presentations were made concerning the deer studies: Ecology of farmland deer--Midwest deer group, Carbondale, Illinois. Status of the cooperative farmland deer project--Annual P-R meeting with IDOC, Champaign, Illinois.

(b) Target Date of Achievement: 1 September 1989.

(c) Date of Accomplishment: Same.

(d) Significant Deviations: None.

(e) Remarks: None.

(f) Recommendations: None.

(g) Cost: Federal - \$1,000; State - \$333; Total - \$1,333

PREPARED BY:

Charles M. Nixon
Forest Wildlife Ecologist
Illinois Natural History Survey

APPROVED BY:

A handwritten signature in cursive script, reading "Glen C. Sanderson", written over a horizontal line.

Glen C. Sanderson, Head
Section of Wildlife Research
Illinois Natural History Survey

DATE: 15 August 1988

Table 1. The 1986 and 1987 reported shotgun deer harvest in Illinois.

Years	Bucks	Percent Bucks	Does	Percent Does	Total	Percent of Total
<u>1986</u>						
0.5	7,138	32	4,918	35	12,056	33
1.5	8,752	40	4,066	29	12,818	36
2.5	4,101	19	3,021	22	7,122	20
3.5	1,673	8	1,379	10	3,052	9
4.5	447	2	561	4	1,008	3

SEX MAKEUP OF KILL: 22,111 Bucks 61% Bucks
 13,945 Does 39% Does

TOTAL KILL = 36,056

NUMBER OF HUNTERS = 93,172

PERCENT OF HUNTERS SUCCESSFUL = 38.7

Years	Bucks	Percent Bucks	Does	Percent Does	Total	Percent of Total
<u>1987</u>						
0.5	10,170	38	5,727	36	15,897	37
1.5	9,993	37	4,660	29	14,653	34
2.5	4,400	16	3,284	21	7,684	18
3.5	1,963	7	1,509	10	3,472	8
4.5	580	2	646	4	1,226	3

SEX MAKEUP OF KILL: 27,106 Bucks 63% Bucks
 15,826 Does 37% Does

TOTAL KILL = 42,932

NUMBER OF HUNTERS = 100,069

PERCENT OF HUNTERS SUCCESSFUL = 42.9

Table 2. Input values for regional demographic parameters of deer used to simulate deer population changes in 16 counties of Illinois during 1980-87.

Input	Values		Source	
Deer Regions				
Reproduction	1-7	8	Platt Co. - live fawns of marked does Roseberry & Klimstra (1970)	
	Fawns per Doe	Fawns per Doe		
	Fawns	.86		.42
	Yearling	1.82		1.69
Adult	2.10	1.85		
Sex Ratio at Birth	Percent Male		Verme (1983)	
	Fawn breeders	62.5		Same
	Yearling breeders	52.6		Same
	Adult breeders	50.2		Same
Age Structure June 1, 1980	Percent of Total		Nixon & Hansen (1986) Modified from Roseberry & Klimstra (1974)	
	Fawns			
	Male	25.8		15.1
	Female	22.4		13.1
	Yearlings			
	Male	11.0		15.2
	Female	11.7		16.1
	Adults			
Male	11.0	15.2		
Female	18.2	25.3		
Mortality	Percent		Best guess based on behavior of Marked deer Platt County 5-year means (unpublished data)	
	June-September			
	Fawns			
	Both Sexes	2-10		15
	Yearling			
	Male	5.6		Same
	Female	7.0		Same
	Adults			
	Male	3.0		Same
	Female	5.0		Same
	October-December			
	Non-harvest			
Fawns				
Male	4.7	Same		
Female	8.3	Same		
Yearling				
Male	13.2	Same		
Female	6.7	Same		
Adults				
Male	10.7	Same		
Female	4.9	Same		

Harvest				Reported harvests IDOC
Shotgun	Variable		Same	Questionnaire sent to
Archery	Variable		Same	5-10% of archers (IDOC
				unpublished data)
Crippling Losses				
Shotgun	30% of reported kill		Same	Marked deer in Platt
Archery	40% of reported kill		Same	County (unpublished
				data)
January-May				
Fawns				
Male	8.0		Same	5-year means from
Female	11.0		Same	marked deer in Platt
Yearling				County (unpublished
Male	19.0		Same	data)
Female	7.0		Same	
Adult				
Male	2.0		Same	
Female	8.8		Same	
Initial Population Size	Variable			Numbers necessary to
June 1, 1980				support known harvest
				levels for 1980-87

Table 3. Estimates of changes in deer numbers, simulated prehunt deer populations, and harvest levels for both sexes for the years 1980-87 in 16 Illinois counties.

Deer Region:	1		2		3		4	
County:	Stephenson	Winnebago	Dekalb	Lee	Fulton	Schuyler	Adams	Macoupin
Percent change in standard kill 1980-87 ^a	+62.2	+100.0	+57.0	+97.8	+78.8	+52.7	+35.7	+76.6
Simulated deer numbers								
Prehunt 1980	1,381	1,098	401	1,095	2,681	1,990	4,585	1,498
1987	2,514	2,083	1,017	2,166	4,717	2,017	6,623	2,706
Change (%)	+82.0	+89.7	+154	+97.8	+75.9	+51.6	+44.4	+80.6
Estimated average harvest 1980-87 (%)								
Fawn M	20.4	19.5	16.5	18.7	20.5	26.3	25.6	20.2
Yearling M	44.2	39.6	45.6	37.2	42.6	47.7	42.9	41.8
Adult M	31.6	49.4	38.9	30.8	48.3	49.4	25.8	36.0
Fawn F	19.9	16.4	15.0	16.2	17.1	21.1	20.7	20.9
Yearling F	29.1	23.5	20.2	23.0	20.8	27.1	26.4	19.5
Adult F	13.2	15.4	18.3	15.2	20.1	19.3	20.9	15.0

Deer Region:	5		6		7		8	
County:	DeWitt	Champaign	Lawrence	Wabash	Clay	Madison	Saline	Union
Percent change in standard kill 1980-87 ^a	+71.7	+65.8	+48.4	+110.4	+63.1	+69.2	+103.2	+53.9
Simulated deer numbers								
Prehunt 1980	683	431	665	385	734	648	1,301	2,931
1987	1,194	812	1,087	936	1,269	1,139	2,649	4,885
Change (%)	+74.8	+88.4	+63.5	+143.1	+72.9	+75.7	+103.6	+66.7
Estimated average harvest 1980-87 (%)								
Fawn M	17.3	18.3	27.6	16.1	29.4	20.8	16.2	18.9
Yearling M	40.8	45.2	48.3	36.2	47.3	43.9	34.3	56.7
Adult M	34.9	39.4	38.1	37.3	45.5	28.1	42.9	41.6
Fawn F	12.9	13.1	19.7	15.4	20.3	16.5	12.9	13.1
Yearling F	24.5	31.1	30.3	17.7	24.5	24.3	17.1	21.0
Adult F	12.4	17.6	14.7	15.5	17.6	13.4	11.9	17.4

^a Standard Kill = the number of hunters in year x - the number of hunters in 1980
(standard year) X hunter success in year x - the kill in year x .

Table 4. Changes in highway kills, harvests, hunter success, and estimated deer numbers in 16 counties for the period 1980-87.

County	Reported highway kills		Percent Increase	Archery and shotgun harvests and crippling losses		Percent Increase	Reported shotgun hunter success		Percent Increase	Simulation of pre-season deer numbers		Percent Increase
	1981	1987		1980	1987		1980	1987		1980	1987	
Stephenson	30	70	133	288	857	198	29.4	47.7	62	1,381	2,514	82
Winnebago	71	214	201	185	764	313	17.7	35.5	101	1,098	2,083	90
Dekalb	6	45	650	79	285	261	20.0	29.5	48			
Lee	21	84	300	199	596	199	18.2	36.0	98	1,095	2,166	98
Fulton	40	76	90	633	1,518	140	29.0	42.7	46	2,681	4,717	76
Schuyler	16	33	106	511	1,007	97	30.6	46.7	53	1,990	3,017	52
Adams	48	72	50	1,149	2,322	102	38.6	52.3	35	4,585	6,623	44
Macoupin	20	70	250	303	924	205	24.7	43.6	77	1,498	2,706	81
Dewitt	15	64	327	102	395	287	26.0	44.5	71	683	1,194	75
Champaign	22	65	195	77	365	374	19.2	31.7	65	431	812	88
Lawrence	16	45	181	153	480	214	33.6	49.8	48	665	1,087	64
Wabash	3	9	200	69	271	293	23.8	50.1	111	385	936	143
Clay	6	24	300	176	558	217	26.8	43.6	63	734	1,269	73
Madison	62	131	111	131	484	269	18.7	31.7	70	648	1,139	76
Saline	19	46	142	271	672	148	18.0	36.6	103	1,301	2,649	104
Union	35	66	88	816	1,386	70	27.5	44.4	61	3,038	4,682	66

Table 5. Estimates of the proportion of the prehunt yearling and older female population that must be removed to stabilize the deer population in 16 counties. The number of "any deer" permits necessary to kill the required number of females is shown, based on 1985-87 hunter success rates for yearling and older does.

Deer Region:	1		2		3		4	
	Stephenson	Winnebago	Dekalb	Lee	Fulton	Schuyler	Adams	Macoupin
Proportionate removal of 1 year+ females required to stabilize population growth	.35	.25	.40	.33	.34	.30	.26	.28
Reported shotgun hunter kill success rate for 1 year and older females 1985-87 (%)	13.7	10.7	8.1	12.5	14.1	12.1	16.5	11.0
Permits issues 1987	1,087	1,156	481	1,049	2,158	1,518	3,032	1,163
Permits needed to stabilize herd	1,062	888	1,197	1,260	2,574	1,764	2,036	1,432
Permit allocation for 1988 & 1989 ^a	no change	Reduce 268	Add 716	Add 211	Add 416	Add 246	Reduce 996	Add 269

Table 5 - continued - Page 2.

Deer Region:	5		6		7		8	
	Dewitt	Champaign	Lawrence	Wabash	Clay	Madison	Saline	Union
Proportionate removal of 1 year+ females required to stabilize population growth	.40	.27	.30	.35	.23	.23	.35	.40
Reported shotgun hunter kill success rate for 1 year and older females 1985-87 (%)	12.8	8.7	12.9	12.1	11.8	7.3	9.1	11.7
Permits Issues 1987	411	417	418	337	720	622	1,216	2,054
Permits needed to stabilize herd	1,250	425	484	620	513	541	2,764	4,410
Permit allocation for 1988 & 1989 a	Add 839	Add 8	Add 66	Add 283	Reduce 207	Reduce 81	Add 1,548	Add 2,356

a Permit allocation for 1988-89 = Calculate the average hunter success rate for harvesting yearling and older does for 1985-87. Determine the number of yearling and older does necessary to stabilize deer numbers from simulation model using simulated deer numbers for 1987 and average values of harvest and non-harvest mortalities for 4 years, 1984-87, for 1988 and 1989 simulation models. Required permits are those necessary to kill estimated pre-hunt yearling and older does given the 1985-87 average hunter success rates for killing yearling and older does.

Table 6. Results of a 1987 landowner questionnaire regarding farmer perception of deer numbers on the farm and preference for more, fewer, or a stable number of deer.

Deer Region	Number of Respondents	Deer Numbers on Farm (%)			Landowner Preference (%) for			Report some deer damage (%)	
		No deer	Some - not enough to hunt	Enough to hunt	More deer	Stable numbers	fewer deer	1987 1982 ^a	
								1987	1982 ^a
1	69	15.9	44.9	39.1	27.5	56.5	14.5	17.4	35
2	150	27.0	39.4	33.6	18.6	72.8	17.5	17.4	49
3	68	7.4	35.3	57.4	19.1	70.6	20.6	19.4	32
4	63	11.1	38.1	50.8	15.9	71.4	20.6	26.9	27
5	75	37.3	34.7	28.0	25.3	60.0	8.0	16.0	38
6	70	17.1	31.4	51.4	14.3	65.7	18.6	25.7	28
7	61	13.1	37.7	49.2	26.2	63.9	18.0	24.6	30
8	66	9.1	30.3	60.6	34.9	54.6	16.7	19.7	29
Statewide	622	18.9	36.8	44.2	22.2	65.4	16.7	21.4	37

^a Kube (1983).

Table 7. Current status of deer on public lands with a tradition of use by deer in winter including hunting status, harvest levels, and severity of damage to crops and natural vegetation.

Deer Region	County	Winter concentration area ^a	Public area		Year open to hunting			Total Harvest	Vegetation	
			Name	Acres	Archery	Shotgun	Native plants		Crops	
1	Boone	1	Kinnikinnick State Nature Preserve	435	Closed	Closed	82-1 83-0 84-13 85-12 86-9 87-16	70-80 deer in 1987-88 winter. No extensive damage as yet	No extensive damage	No crop damage
			Conservation District	154	Closed	Closed	82-1 83-0 84-13 85-12 86-9 87-16	No extensive damage	Some crop damage	
	McHenry	3	McHenry Conservation District	154	Closed	Closed	82-1 83-0 84-13 85-12 86-9 87-16	No extensive damage	Some crop damage	
			McHenry Conservation District	235	Closed	Closed	82-1 83-0 84-13 85-12 86-9 87-16	No extensive damage	Some crop damage	
			Portion of Chain O'Lakes State Park	716	1982	Closed	82-1 83-0 84-13 85-12 86-9 87-16	Extensive damage	Many complaints	
Ogle	2	Castle Rock State Park	1,966	1981	1980 (1,200+ acres closed)	80-2 81-11 82-8 83-10 84-13 85-10 86-10 87-16	Extensive damage	Extensive damage		
		White Pines State Park	385	Closed	Closed	80-2 81-11 82-8 83-10 84-13 85-10 86-10 87-16	Some damage	Occasional complaints		
Stephenson		1	Lake-Le-Aqua-Na State Park	716	Closed (pressure building to harvest deer)	Closed	80-2 81-11 82-8 83-10 84-13 85-10 86-10 87-16	Extensive damage	Annual complaints	

Winnebago	1	Severson Forest Preserve	358	Closed	Closed	---	85 deer counted on 300 acres 1987-88 Significant damage Occasional damage
	2	Pecatouca Forest Preserve	384	Closed	Closed	---	Some damage Some damage
	3	Rock cut State Park	2,658	Recommended for 1988	Closed	---	Counted 295 deer on 4.8 mi ² winter 87-88. Significant damage to crops and natural vegetation. Very high highway kill on adjacent I-90.
	5	Rockford City Parks	435+	Closed	Closed	---	Page Park - only 9 deer seen, 87-88. No vegetation damage.
	4	Sugar River Forest Preserve	256	Closed	Closed	---	No damage No complaints
Whiteside	1	Morrison-Rockwood State Park	1,164	Closed	Open to 35 hunters in 1988		Extensive damage Annual complaints
	2	Big Bend Conservation Area	1,188	1972	Closed	76-4 77-0 78-2 79-2 80-2 81-2 82-0 83-5 84-2 85-6 86-3 87-7	No damage Some complaints
Bureau	2	County Park	80	Closed	Closed	---	Small amount In Fall Some complaints

2	Dekalb	1	Shabonna Lake State Park	1,565	1983	Closed	83-0 84-5 85-1 86-10 87-10	G. Hubert reports 250-300 deer present 87-88. Increasing damage Complaints increasing
		2	Russell Forest	128	Closed	Closed	---	G. Hubert estimates 200+ deer in vicinity Some damage Occasional complaints
		3	County Forest Preserve	51	Closed	Closed	---	50-100 deer in vicinity of refuge Some damage A few complaints
	Grundy	1	Goose Lake Prairie	2,435	Closed	Closed	---	Very heavy damage. Road kills >40 in 1987.
		2	Boy Scout Camp	281	Open	Open	No data	No damage No reports
	Henry	2	Johnson-Sauk Trail State Park	1,361	1977	Closed	77-2 78-3 79-1 80-6 81-7 82-4 83-1 84-4 85-6 86-2 87-5	Damage in Fall Annual complaints
	Iroquois	1	Iroquois County Conservation Area	1,920	1977	1974	77-13 78-9 79-11 80-13 81-11 82-18 83-34 84-25 85-45 86-40 87-47	Some damage Annual complaints

Kankakee	2	Kankakee River State Park	3,512	1978	1980-81 Closed other years	78-4 79-35 80-31 81-3 82-4 83-4 84-2 85-8 86-10 87-10	No damage	Annual complaints					
	3	Kankakee River State Park	Same	Same	Same	Same	Same	Same					
Kendall	4	Sliver Springs State Park	1,314	1977	1980	86-2 87-4	Some damage	Some damage each year					
	3	Marseilles Conservation Area	2,550	1980	1965	80-6 81-12 82-14 83-11 84-10 85-9 86-29 87-18	100+ deer on site Some damage	Annual complaints					
	5	Starved Rock State Park	2,626	Closed	Closed	---	Some damage	At times considerable damage					
	8	Camp Merrybrook (Girl Scouts)	154	Closed	Closed	---	Some damage	Extensive damage					
	10	Camp Cloverleaf (Girl Scouts)	307	Closed	Closed	---	20-30 deer present Some damage	Complaints of feeding in clover fields					

(poor reporting)

Lee	1	Green River Conservation Area	2,330	1977	1957	77-11 78-13 79-8 80-11 81-11 82-14 83-11 84-13 85-5 86-9 87-4	Low harvest - deer not abundant
	2	Dixon City Park	512	Closed	Closed	---	No damage
	3	Dixon State Park	593	Closed	Closed	---	No damage
McLean	1	Natural areas U of I and Funks Grove	262	Closed	Closed	---	Some damage Areas part os large forest owned by Funk seed foundation - many deer present
	5	Evergreen Lake County Park	1,151	Closed	Closed	---	Deer abundant - damage complaints increasing
	7	Moraine View State Park	306	1977	Closed	77-5 78-2 79-2 80-2 81-5 82-1 83-4 84-12 85-8 86-6 87-8	No damage
2	1	Kankakee State Park	307	Closed	Closed	---	Some damage
2	3	Sauk Trail Preserve	486	Closed	Closed	---	Some damage No farmers present

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2	WIII	9	Joliet Arsenal	2,481	1975	1975	75-44 76-35 77-45 78-0 79-37 80-38 81-31 82-51 83-47 84-53 85-61 86-76 87-75	Some damage to corn and beans						
2	WIII	10	Joliet Arsenal	870	1975	1975		Some damage Property manager estimates 1,000 deer present						
2	WIII	11	Joliet Arsenal	2,558	1975	1975								
2	WIII	4	Raccoon Grove Forest Preserve	972	Closed	Closed	---	Some damage	No farmland present					
2	WIII	5	Plum creek Forest Preserve	691	Closed	Closed	---	Some damage	No farmland present					
			Desplaines Conservation Area	4,253	1982	Closed	82-3 83-0 84-5 85-4 86-8 87-27	Extensive damage to shrubs and ground cover.	Extensive damage - IDOC considering shotgun hunting.					
3	Henderson	1	Big River State Forest	307	Open since 1957			None	Occasional					
3	Henderson	2	Big River State Forest	1,458	Open since 1957			None	Occasional					
3	Henderson	3	Big River State Forest	947	Open since 1957			None	Occasional					

Table 7 - continued. Page 7

3	Marshall	2	Marshall County State Area	256	1977	1957 Permit?	76-3 77-3 78-4 79-2 80-1 81-1 82-3 83-4 84-3 85-7 86-4 87-3	None	None
3	Mason	3	Sand Ridge State Park	1,791	1957	1957	≈ 60/yr	Very little	Very little
3	Mason	4	Sand Ridge State Park	2,379	1957	1957	≈ 60/yr	Very little	Very little
3	Mason	6	Sanganols Conservation Area	256	1957	1957		None	None
3	Mason	8	Sand Prairie Scrub Oak Nature Preserve	1,460	Closed	Closed	---	Extensive damage	Continuing problem
3	Mercer	8	Mark Twain Wildlife Refuge	128	Closed	Closed	---	None	None
3	Peoria	1	Peoria City Parks	333	Closed	Closed	---	None	None
3	Peoria	2	Peoria City Parks	512	Closed	Closed	---	None	None
3	Peoria	5	Jubilee College State Park	1,458	1982	Closed	82-12 83-3 84-2 85-6 86-1 87-6	Definitely noticeable	Some
								Only hunt 400 acres. Trying to enlarge area open to hunting.	

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3	Peoria	6	Jubilee College State Park	128	1982	Closed	Trying to enlarge area open to hunting.
3	Peoria	10	County Park	563	Closed	Closed	None
3	Putnam	4	County Preserve	281	Closed	Closed (poaching)	Damage ornamental plantings
3	Rock Island	1	Loud Thunder Forest Preserve	1,330	Closed	Closed	Some; gets many complaints from farmers
3	Rock Island	2	Mark Twain Wildlife Refuge	77	Closed	Closed	Damage to seedlings
3	Rock Island	3	Mark Twain Wildlife Refuge	205	Closed	Closed	None
3	Tazewell	1	Parklands Recreation Area	512	1982	1976	None
						82-3	Increasing
						83-5	Yes, more to beans than corn
						84-3	
						85-3	
						86-17	
						87-19	
3	Tazewell	3	Klamm Memorial Woods	80	Closed	Closed	None - Increasing deer population
3	Tazewell	6	Caterpillar Proving Grounds	51	Closed (Poaching a problem)	Closed	None
3	Tazewell	8	County Park	870	Closed	Closed	None-herd increasing
3	Woodford	4	County Park	281	Closed	Closed (poaching)	None reported
							Some damage - Population large

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				1981	1981	1981	1981	1981	1981			
4	Cass	2	Panther Creek Wildlife Management Area	205	205	1981	Closed	1981	1981	None	None	None
4	Cass	9	Meredosa National Wildlife Refuge	1,023	1,023	1981	Closed	1981	1981	---	Some damage - herd increasing	Probably some; not significant
4	Cass	10	Sangano's State Conservation Area	1,970	1,970	1957	1957	1957	1957	No check station	Floods chase deer out - low population. May be Coyote problem.	Not much
5	Champaign	1	Lake of the Woods Forest Preserve	205	205	1981	1981	1981	1981	---	Not much	Not much
5	Champaign	2	Salt Fork Forest Preserve	665	665	1981	1981	1981	1981	---	Problem at nearby nurseries; browse line present.	Increasing
5	Champaign	3	Champaign County Forest Preserve	1,228	1,228	1981	1981	1981	1981	---	Damage to some seedlings occur	Some damage
5	Champaign	4	U of I	279	279	1981	1981	1981	1981	---	Not apparent - herd increasing	Some damage to corn and beans
5	Christian	1	Sangchr's Lake State Park	942	942	1980	1980	1980	1980	80-11 81-6 82-11 83-0 84-44 85-151 86-72 87-97	Favorite browse is bur oak. Problem 4 yrs. ago. Had special hunt. Destroyed 30 acres sun flowers. Aerial count of 334 deer on 600 acres in 1984-85.	Probably some damage
5	DeWitt	1	Clinton Lake Fish & Wildlife Area	819	819	1979	1979	1979	1979	80-0 81-6 82-3 83-6 84-12 85-13 86-5 87-11	Yes, extensive	Yes, getting worse

5	DeWitt	3	Weldon Springs State Park	51	Closed	Closed	---	None	Some damage				
5	DeWitt	4	Clinton Lake Fish & Wildlife Area	819	1979	Closed	80-0 81-6 82-7 83-0 84-12 85-13 86-5 87-11	Yes, extensive	Yes				
5	Logan	4	Rallsplitter State Park	844	Closed	Closed	---	Deer abundant - some damage	Some damage				
5	Moultrie	1	Kaskaskia River State Fish & Wildlife Area	1,484	1972	1972		None - deer widely dispersed by humans.	None				
5	Moultrie	3	U. S. Corp of Engineers	333	1972	1972		None	None				
5	Moultrie	4	West Okaw R. State Fish & Wildlife Area	1,177	1972	1972		None	None				
5	Platt	1	U of I	1,500	Closed	Closed	---	Extensive - winters 100+ deer	Some				
5	Platt	2	Platt County Forest Preserve	230	Closed	Closed	---	None	None				
5	Sangamon	1	Springfield City Parks	896	Closed	Closed	---	None	None				
6	Coles	5	Fox Ridge State Park	537	1977	1977	84-2 85-0 86-3 87-3	Minimal	Minimal				

Table 7 - continued. Page 11

6	Douglas	3	Walnut Point State Park	512	Closed	Closed	---	Likely some damage	Yes, fence and crops
6	Vermillion	1	Middle Ford Fish & Wildlife State Area	358	1979	1974 (permit only)	80-16 81-15 82-20 83-15 84-32 85-38 86-33 87-50	Some damage	Some - heavier in last 3-4 years
6	Vermillion	2	Middle Ford Fish & Wildlife State Area	179	1979	1974		Some damage	Some damage
6	Vermillion	3	County Park and State Fish & Wildlife Area	435	1980	1980	80-0 81-9 82-0 83-10 84-18 85-38 86-33 87-50	Some	Some
6	Vermillion	4	County Park and State Fish & Wildlife Area	1,023	1980	1980			
6	Vermillion	5	Forest Preserve	1,330	Closed	Closed	---	Some damage	Damage to corn and beans
6	Vermillion	6	U of I	486	Closed	Closed (poaching)	---	None - poaching is a problem	Comparable to Forest Glen
6	Vermillion	7	Kickapoo State Park	126	1974	1986	85-17 86-3 87-12	None	Several complaints
7	Shelby	2	U.S. Corps of Engineers	972	Do allow hunting Kill Unknown	Unknown	Has increased each year.	None Likely some damage	None in and around Lake.

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7	Shelby	3	Eagle Creek State Park	2,328	1977	1981	78-2 79-2 80-4 81-0 82-0 83-0 84-2 85-2 86-3 87-22	None Poaching may be a problem	None
7	Shelby	4	Wolf Creek State Park and U.S. Corps Engineers	1,202	Closed	Closed	---	Population high. Limited hunt was proposed for 1988.	Some damage
7	Shelby	1	Shelbyville Fish & Wildlife Area	6,350	1977	1981	77-2 78-0 79-0 80-1 81-33 82-37 83-34 84-69 85-48 86-69 87-55	Not noticeable	A few each year

a Number of area refers to number assigned to each winter area in each county. See Nixon and Hansen (1986) for list of areas.

Table 8. Indices to dispersion of traditional sites of winter deer concentrations in 46 counties in central and northern Illinois.

Deer Region	County	Average Distance Between Sites (km)	Number Occupied Townships	Percent of all Townships	Average Number Sites per Occupied Township
1	Boone	6.7	2	33	1.5
	McHenry	8.2	5	29	1.0
	Ogle	.5	3	12	1.3
	Stephenson	17.0	2	10	1.0
	Winnebago	9.0	5	31	1.0
	Whiteside	7.0	5	24	1.0
	Regional means	8.1	3.7	23.2	1.1
2	Bureau	1.7	5	20	1.2
	Dekalb	2.8	6	31	1.2
	Ford	10.5	2	17	1.0
	Grundy	4.4	4	25	1.3
	Henry	6.2	6	25	1.0
	Iroquois	9.2	9	30	1.1
	Kankakee	3.3	5	31	1.4
	Kendall	1.5	2	22	2.0
	LaSalle	3.3	8	26	1.3
	Lee	3.7	6	27	1.5
	Livingston	6.1	7	23	1.1
	McLean	7.3	7	23	1.0
	Stark	2.3	3	38	1.3
	Will	3.4	8	33	1.4
Regional means	4.7	5.6	26.5	1.3	
3	Henderson	1.6	5	50	2.2
	Knox	1.6	7	35	1.6
	Marshall	8.0	3	25	1.0
	Mason	3.3	6	46	1.3
	Mercer	4.1	6	38	1.7
	Peoria	1.6	8	44	1.5
	Putnam	0.5	4	100	1.5
	Rock Island	2.8	4	33	1.5
	Tazewell	0.9	5	28	1.6
	Warren	3.4	6	40	1.3
	Woodford	0.7	4	29	1.8
Regional means	2.6	5.3	42.5	1.5	
4	Cass	1.3	8	73	1.3
	Morgan (N half)		Total of 6 sites		

5	Champaign	14.8	4	13	1.0
	Christian	19.0	1	6	2.0
	Dewitt	2.0	3	21	1.3
	Logan	10.0	3	18	1.3
	Macon	--	1	6	1.0
	Menard	2.3	3	33	1.7
	Moultrie	5.5	4	40	1.0
	Piatt	9.3	3	19	1.0
	Sangamon	5.2	4	15	1.3
	Regional means	<u>8.5</u>	<u>2.9</u>	<u>19</u>	<u>1.3</u>
6	Coles	2.4	5	42	1.4
	Douglas	3.0	3	33	1.3
	Edgar	1.1	6	40	1.2
	Vermillion	1.9	6	32	1.5
		Regional means	<u>2.1</u>	<u>5</u>	<u>36.8</u>

Table 9. Regional means (\bar{X}) and standard errors (SE) for variables describing the landscape, human presence, and topographic relief found in 4-mi² sites of deer concentration in winter.

	Deer Region							
	1 n = 19	2 n = 102	3 n = 89	4 n = 16	5 n = 33	6 n = 27	7 n = 4	Total n = 290
Number of sites	19	102	89	16	33	27	4	290
Private ownership (%)	\bar{X} 84.3 SE 5.36	88.7 ^a 2.32	93.2 4.10	92.2 5.25	89.0 3.02	92.9 2.89	56.0 18.69	90.0 ^b 1.21
Total Forest (ha) ⁱ	\bar{X} 312.5 SE 42.55	194.1 12.02	322.3 14.19	291.2 47.74	212.7 14.75	277.7 19.42	214.1 25.78	256.7 9.23
Hardwoods >50% closure (ha) ^j	\bar{X} 280.0 SE 50.14	172.5 11.43	252.6 15.28	233.2 46.72	161.6 12.26	245.0 19.22	187.6 28.09	213.2 8.10
Upland >50% closure 50+ years, not pastured (ha) ^k	\bar{X} 144.9 SE 36.18	79.2 7.23	204.3 13.74	112.3 14.51	83.2 8.50	189.0 20.08	149.4 21.43	135.4 6.74
Upland >50% closure, 50+ years, pasture (ha) ^l	\bar{X} 112.9 SE 31.88	46.5 6.55	6.9 1.27	11.8 2.78	8.6 1.27	7.4 1.18	6.4 2.37	27.4 3.35
Upland >50% closure, <50 years, not pastured (ha) ^m	\bar{X} 20.7 SE 16.21	9.6 1.93	19.3 2.86	29.5 5.95	33.5 5.36	24.3 3.80	19.5 9.87	18.6 1.76
Upland >50% closure, <50 years, pasture (ha) ⁿ	\bar{X} 12.3 ^c SE 5.75	3.2 0.72	1.8 0.97	5.0 1.69	3.5 1.83	1.2 1.50	0 --	3.2 ^d 0.57
Bottom >50% closure, 50+ years, not pastured (ha)	\bar{X} 7.3 SE 4.26	24.4 6.86	15.8 5.33	50.5 36.05	26.4 8.01	20.4 3.60	12.3 7.73	21.7 3.66
Bottom >50% closure, 50+ years, pasture (ha)	\bar{X} 0 ^c SE --	3.3 0.98	0 --	0 --	1.9 1.32	0.2 0.22	0 --	1.4 ^d 0.39
Bottom >50% closure, <50 years, not pastured (ha)	\bar{X} 1.0 SE 0.85	2.6 0.97	0.9 0.62	24.1 23.43	5.0 1.73	2.5 0.75	0 --	3.4 1.36
Bottom >50% closure, <50 years, pasture (ha)	\bar{X} 0 ^c SE --	0.3 0.15	0 --	0 --	0 --	0 --	0 --	0.1 ^d 0.05

Table 9 - continued.

Table 9. Continued - page 2.

	Deer Region								Total n = 290
	1 n = 19	2 n = 102	3 n = 89	4 n = 16	5 n = 33	6 n = 27	7 n = 4		
Hardwoods <50% closure (ha) ^o	\bar{X} 54.1 SE 11.11	21.3 2.32	52.7 4.87	57.9 8.63	49.0 7.15	32.5 2.21	26.6 12.07	39.4 2.25	
Upland <50% closure, 50+ years, not pastured (ha)	\bar{X} 1.4 SE 0.87	0.7 0.28	11.1 2.07	4.1 1.13	4.0 1.28	2.0 0.51	4.1 1.58	4.6 0.71	
Upland <50% closure, 50+ years, pasture (ha)	\bar{X} 23.8 ^c SE 5.57	11.4 1.80	19.6 2.48	16.3 4.03	11.3 2.47	15.5 1.49	18.0 9.77	15.4 ^d 1.14	
Upland <50% closure, <50 years, not pastured (ha)	\bar{X} 4.4 SE 3.20	1.1 0.40	7.9 2.79	12.2 4.59	11.7 3.71	2.2 0.72	0.3 0.25	5.3 1.04	
Upland <50% closure, <50 years, pasture (ha)	\bar{X} 24.3 ^c SE 5.73	5.8 1.06	13.0 3.08	25.1 6.55	12.0 2.23	10.9 1.29	3.0 2.95	11.3 ^d 1.21	
Bottom <50% closure, 50+ years, not pastured (ha)	\bar{X} 3.5 SE 3.55	6.6 6.33	0.1 0.06	0.1 0.10	7.1 3.53	0.6 0.34	1.3 1.30	3.5 2.27	
Bottom <50% closure, 50+ years, pasture (ha)	\bar{X} 0.8 ^c SE 0.83	1.0 0.34	0.5 0.29	0 --	0.8 0.43	0.3 0.19	0 --	0.7 ^d 0.17	
Bottom <50% closure, <50 years, not pastured (ha)	\bar{X} 2.2 SE 2.22	1.0 0.51	0.3 0.20	0 --	1.6 0.98	0.5 0.29	0 --	0.8 0.26	
Bottom <50% closure, <50 years, pasture (ha)	\bar{X} 1.6 ^c SE 1.46	0.6 0.23	0.3 0.23	0 --	0.4 0.23	0.5 0.35	0 --	0.5 ^d 0.14	
Shrub-Oldfield (ha)	\bar{X} 36.8 SE 18.75	37.5 11.77	24.2 4.48	28.1 5.27	37.2 8.10	32.3 3.98	34.3 11.29	32.3 4.64	
Railroad Right of Way (ha) ^p	\bar{X} 1.6 SE 1.20	1.5 0.36	0.5 0.18	0 --	11.5 4.15	3.6 2.22	15.4 15.38	2.7 0.60	
Cropland (ha) ^q	\bar{X} 585.0 SE 54.10	704.6 19.15	637.3 16.23	626.1 51.12	708.5 21.32	683.1 21.65	611.4 71.88	668.9 10.24	
Conifers (ha)	\bar{X} 5.6 SE 2.59	1.6 0.58	4.2 2.45	12.8 11.24	2.6 2.13	1.4 0.42	2.8 2.78	3.39 1.04	

Table 9 - continued.

Table 9. Continued - page 3.

		Deer Region							Total n = 290
		1 n = 19	2 n = 102	3 n = 89	4 n = 16	5 n = 33	6 n = 27	7 n = 4	
Pasture (ha)	\bar{X}	38.1	44.0	25.8	30.8	24.1	14.9	11.3	31.9
	SE	9.00	5.76	2.09	4.64	3.21	2.20	5.77	2.33
Other (water, mines, etc.) (ha) ^r	\bar{X}	19.0	38.1	19.5	22.6	35.1	24.6	146.8	30.2
	SE	6.97	6.20	4.82	19.03	12.68	7.32	84.79	3.54
No. of occupied houses	\bar{X}	45.9	47.6	33.2	19.0	35.4	38.3	15.5	38.8
	SE	9.11	5.77	4.48	4.87	7.09	4.79	3.93	2.73
Unimproved roads (km)	\bar{X}	4.2	6.1	5.0	6.6	2.9	3.1	1.9	5.0
	SE	0.87	1.54	0.88	1.36	0.43	0.35	0.61	0.62
Light duty roads (km)	\bar{X}	8.5	10.2	11.2	8.6	10.0	11.8 ^e	10.6	10.4 ^f
	SE	1.27	0.68	1.54	1.44	1.07	1.11	2.42	0.57
Secondary highways (km)	\bar{X}	3.2	4.1	1.4	0.6	1.4	0.7 ^e	2.6	2.38 ^f
	SE	0.65	1.05	0.25	0.35	0.33	0.23	1.96	0.39
Primary highways (km)	\bar{X}	1.2	1.7	0.4	0	0.3	0.1 ^g	0	0.9 ^h
	SE	0.50	0.63	0.13	--	0.18	0.14	--	0.23
Interstate highways (km)	\bar{X}	0.2	0.3	0.1	0	0.2	0	0	0.2
	SE	0.13	0.14	0.07	--	0.15	--	--	0.06
Northeast transect (No. of 3.1 m contour lines) ^s	\bar{X}	54.6	43.5	84.1	66.5	49.1	56.1	60.8	59.8
	SE	6.34	2.42	3.59	7.42	4.78	5.01	3.61	1.95
Northwest transect (No. of 3.1 m contour lines) ^t	\bar{X}	50.6	42.2	82.1	62.0	50.7	68.9	61.8	59.8
	SE	4.58	2.54	3.57	6.20	4.83	6.97	2.69	1.96
Total topographic relief (m) ^u	\bar{X}	146.6	92.8	138.3	105.3	83.8	116.2	96.3	112.1
	SE	11.21	5.27	6.29	13.02	7.87	11.71	14.05	3.44

a n = 101

b n = 289

c n = 16

d n = 287

e n = 26

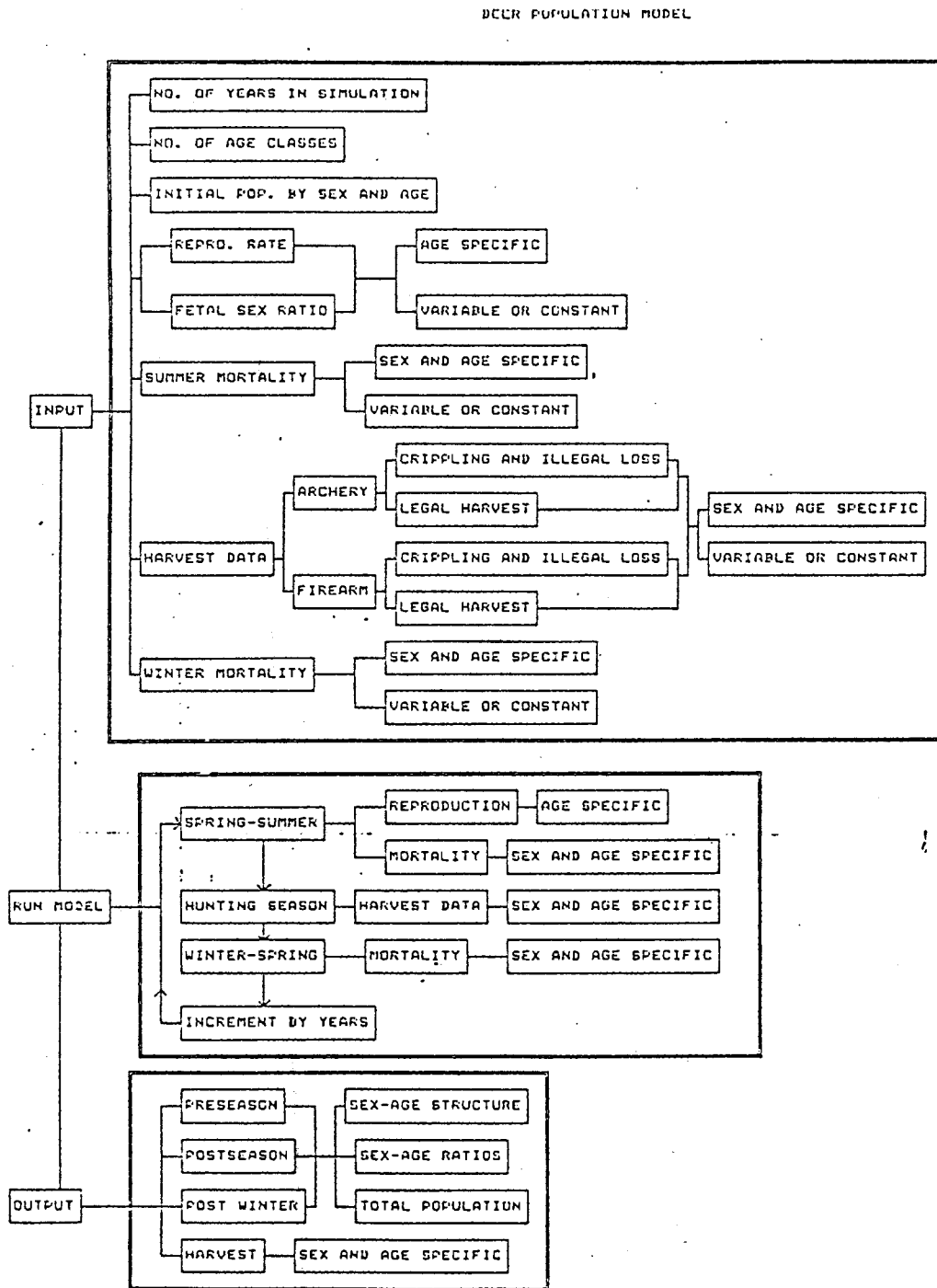
f n = 289

g n = 25

h n = 288

- i Region 2 significantly lower than Regions 1, 3, 4, and 6; Regions 5 and 7 significantly lower than Regions 1, 3, and 4.
- j Regions 5 and 2 significantly lower than Regions 1, 3, and 6.
- k Region 2 significantly lower than Region 6.
- l Region 1 significantly higher than all other regions.
- m Region 2 significantly lower than Regions 4, 5, and 6; Region 2 significantly lower than Region 5.
- n Region 1 significantly higher than all other regions.
- o Region 2 significantly lower than Region 4.
- p Region 5 and 7 significantly higher than all other regions.
- q Region 1 significantly lower than Regions 2 and 5.
- r Region 7 significantly higher than all other regions.
- s Region 2 significantly lower than Regions 3 and 4; Region 3 significantly higher than Regions 1, 5, and 6.
- t Region 2 significantly lower than Regions 3, 4, and 6; Regions 1 and 5 significantly lower than Region 3.
- u Region 5 significantly lower than Regions 1, 3, and 6; Region 2 significantly lower than Regions 1 and 3.

FIGURE 1. Diagrammatic Outline of Deer Population Model



APPENDIX 1

LIFE HISTORY AND ECOLOGY OF WHITE-TAILED DEER IN AN INTENSIVELY FARMED REGION OF ILLINOIS

CHARLES M. NIXON, LONNIE P. HANSEN, PAUL A. BREWER, AND JAMES E. CHELSVIG
Illinois Natural History Survey, 607 E. Peabody Drive, Champaign, IL 61820

ABSTRACT: White-tailed deer (*Odocoileus virginianus*) were studied on and adjacent to a 600-ha refuge in eastcentral Illinois from 1980 through 1985. Marked deer (N = 287), a portion radio marked (N = 38 males, 58 females), were used to determine the demographic characteristics, seasonal movements, social interactions, habitat selections, and value of refugia to deer in landscapes with <6% forest cover and that are heavily impacted by human activities. Deer numbers were increasing both on and off the refuge during the study, due to high natality rates, very high fawn survival (>90%) up to hunting season, and relatively high survival of yearling and older females protected by refuge and by hunter preferences for antlered males. Yearling and older males exhibited significantly lower survival and significantly larger home ranges compared with females as the greater movements of these two age classes of males during the fall promoted high hunting losses.

Between April and June each year, about half the fawn crop and 20% of the yearling females dispersed away from the study area, moving an average of 45-50 km before settling on a new home range. Both sexes tended to settle in vacant ranges, those where deer were killed during hunting or where habitats were seasonally hostile in winter. An additional 20% of the yearling and older females were seasonal migrators, moving an average of 13 km away in spring and returning to the study area in late fall or early winter. After age 10-14 months nearly all deer were sedentary, faithful

until death to seasonal ranges selected before the age of 15 months. Survival after marking was significantly reduced for dispersing females but not for males, which were not protected from hunter predation by the 600-ha refuge.

Fawns that did not disperse utilized some or all of their mother's range and associated with her throughout the year. Home ranges of adjacent females overlapped in space but not in time. Related females shared more of their home ranges than did strangers in all seasons. During May-June related females remained at least 250 m apart while sharing the same general ranges. Habitat use was similar by both sexes except in summer. Between June and September, mature males (3+ years) vacated areas used by females to rear fawns and moved to sparsely forested habitats dominated by row crops. In other seasons both sexes favored early successional upland forests (<60 years old) and forage crops, avoided flood prone bottomland forests, and utilized row crops as they occurred. Bottomland forests and upland mature oak-hickory forests were avoided by pregnant and nursing does. Foods were mostly gleaned from farm fields and were abundant throughout the year. Deer were in good to excellent condition based on natality rates, chest and hind foot measurements, levels of nutrition indicators in blood sera, antler size, and social play behavior.

Extensive female dispersal in white-tailed deer appears to be confined to the highly fragmented ranges of the agricultural Midwestern states, where high fertility of fawns creates intense competition for defensible parturition sites. Dispersal may be maintained as an evolutionary strategy in the face of high mortality because of improved fitness experienced by sedentary deer. The extinctions and reinvasions of deer that characterize these sparsely forested landscapes are dependent upon scattered refugia for

annual restocking, with annual success dependent on distance from refugia, as postulated in island biogeography theory. Refugia are necessary for deer to live long enough to develop a tradition of range use, and to pass these traditions on to succeeding generations through matrilineal associations. The conceptual relationships between deer (natality, survival, and seasonal movements) and their environment (abundant food, scattered cover, refuge vs. no refuge from hunting, and seasonally hostile vs. seasonally benign environments) are described.

APPENDIX 2

CHARACTERISTICS OF WINTER HABITATS USED BY DEER IN ILLINOIS

CHARLES M. NIXON, Illinois Natural History Survey, Natural Resources Building, 607 E. Peabody, Champaign, IL 61820

LONNIE P. HANSEN,¹ Illinois Natural History Survey, Natural Resources Building, 607 E. Peabody, Champaign, IL 61820

PAUL A. BREWER,² Illinois Natural History Survey, Natural Resources Building, 607 E. Peabody, Champaign, IL 61820

ABSTRACT: We examined characteristics of winter habitats used by white-tailed deer (*Odocoileus virginianus*) on intensively farmed land in central and northern Illinois. Forty-three variables were measured to describe land use and human presence within 10.36-km² blocks centered within 32 wintering sites of deer and 31 sites avoided by deer in winter. The percent of forest in refuge, total forest available, unpastured upland forest >50 years old, shrub-old field, and total upland forest available were significantly correlated ($P < 0.05$) with deer presence in winter. Only the percent of forest in refuge and the total forest available had significant influences on deer presence in winter when all 5 variables were used together in discriminant analysis. Use of the 2-variable model to classify sites where deer were located or where they were absent in winter averaged 83% correct for the 63 sites examined. Refugia or large blocks of forest, or both, are necessary for successive generations of deer to live long enough to develop traditions of use for specific sites in the intensively farmed, dispersed woodland ranges in the Midwestern United States.

¹Present address: Missouri Department of Conservation, 1110 College Avenue, Columbia, MO 65201.

²Present address: Illinois Department of Conservation, Charleston, IL 61920.

State Natural History Survey Division

ENR



Natural Resources Building
607 East Peabody Drive
Champaign, IL 61820
217/333-6880

Illinois Department of
Energy and Natural Resources

12 August 1988

Mr. Steve Gonzalez
Division of Grant Administration
Illinois Dept. of Conservation
Lincoln Tower Plaza
524 S. 2nd Street
Springfield, IL 62706

Dear Steve:

Five copies of the Annual Job Progress Report for Project W-87-R-9 (Illinois Forest Game Investigations--Farmland Deer Project) are enclosed. According to our contract, this report is due on or before 15 August 1988. I am also sending single copies of this report to T. Miller, Jack Ellis, Frosty Loomis, and John Kube.

Please call me if you have questions.

Sincerely,

Glen C. Sanderson, Head
Section of Wildlife Research

GCS:ea
Enclosures

CC: T. Miller
Jack Ellis
Frosty Loomis
John Kube
Bill Edwards ✓
Chuck Nixon
Jim Witham

FIGURE 1. Diagrammatic Outline of Deer Population Model

