ILLINOIS

UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

PRODUCTION NOTE

University of Illinois at
Urbana-Champaign Library
Large-scale Digitization Project, 2007.

ILLINOIS NATURAL HISTORY SURVEY

Section of Wildlife Research

Annual Job Progress Report

Submitted to

ILLINOIS DEPARTMENT OF CONSERVATION

DIVISION OF WILDLIFE RESOURCES

Project Number W-87-R-8

Biology, Ecology, and Management of Deer in the Chicago Metropolitan Area

1 July 1986 - 30 June 1987

by

James H. Witham and Jon M. Jones

28 September 1987

Performance Report

Annual
Job Progress Report

State: Illinois **Project Number:** W-87-R-8

Project Type: Research

Project Title: Cooperative Forest Wildlife Research

Sub-Project VII-D: Biology, Ecology, and Management of Deer in the Chicago Metropolitan Area

This is a progress report covering job segment W-87-R-8, Sub-Project VII-D; the final report will be forthcoming at the end of the current 3-year segment to conclude on 30 June 1989.

Study No. 104-1: Life History and Ecology of an Urban Deer Herd

Study Objectives: To investigate and quantify pertinent aspects of life history, ecology, health, abundance, dynamics, and distribution of deer in metropolitan areas of northeastern Illinois relative and necessary to their successful management.

Study No. 104-2: Deer Range Evaluation for Metropolitan Northeastern Illinois

Study Objectives: To measure, map, and otherwise quantify and qualify the present and potential deer range of northeastern Illinois including assessments of present impacts of deer on vegetation.

Study No. 104-3: Management Strategies and Implementation of Experimental Control of Urban Deer

Study Objectives: To design, implement, and evaluate possible alternative strategies for management of deer in urban areas with special respect to northeastern Illinois. Pilot management programs to be undertaken as cooperative programs with the Illinois Department of Conservation and local public agencies sustaining significant deer problems.

Study No. 104-4: Data Base Management, Analysis, and Reporting on Urban Deer Research

Study Objectives: To compile; organize; computerize; and manage for ready access, security, and preservation all data resulting from this study relating to deer, deer range, and other aspects of natural resource information generated by this project. Data to be integrated into data base management system. To generate file and management reports, scientific and professional manuscripts for publication, and news releases for local and statewide distribution.

Need: White-tailed deer numbers in northeast Illinois have increased substantially during the past 30 years. As a consequence of larger deer numbers and rapid urbanization, the frequency of negative deer-human interactions, such as deer-vehicle collisions and damage to ornamental vegetation, has increased to problem proportions. It is apparent that deer numbers have increased to a level where some form of deer control will probably be necessary. Although white-tailed deer have been extensively studied, no research has comprehensively addressed the complex array of factors that influence abundance and constrain deer management in urban environments. In northeastern Illinois, existing data on the white-tailed deer population have been inadequate to define guidelines for managing local herds.

(a) Activity

Study No. 104-1: Life History and Ecology of an Urban Deer Herd

Aerial counts and deer distribution

Mild conditions with limited snowfall typified winter weather for a second straight year. Conditions suitable for aerial surveys lasted only 3 weeks. One week, when snow conditions were suitable, was lost because the Illinois Department of Transportation helicopter was inoperable. Our original intention to conduct a complete deer census of four northeast Illinois counties and to estimate survey precision was not realized this year.

Deer were counted in northern Cook County for the fourth consecutive year (Table 1). Deer were surveyed on the same DuPage County Forest Preserves that were flown in 1985 (Table 2). Locations of winter concentrations of deer were identified in Kane County during a 2-day survey by fixed-wing aircraft (Fig. 1).

The total number of deer counted in northern Cook County during 1987 was lower than counts made in 1986. Substantially fewer deer were observed in the Des Plaines Division (-33%), Indian Boundary Division (-25%), Ned Brown Preserve (-38%), and Skokie Division (-18%).

With one exception, counts of deer in DuPage County were not remarkable. The exception was the Waterfall Glen (986 ha) and Argonne National Laboratory (605 ha) complex east of Bolingbrook. Two hundred seventeen white-tailed deer were counted on Waterfall Glen. Thirty white-tailed deer and 56 white

fallow deer (Dama dama) were observed on Argonne property. The white fallow deer were extremely difficult to detect against snow cover. This difficulty was subsequently verified by DuPage County Forest Preserve District biologists who accounted for a total of 330 fallow deer on Argonne and Waterfall Glen properties at time of our helicopter survey (Ludwig, DCFPD, pers. commun.).

Deer counts were made in Kane County by fixed-wing aircraft with 2 observers. One hundred ninety eight deer were counted during a 2-day survey in which all areas west of the Fox River were flown. The Kane County landscape west of the Fox River is dominated by agriculture. No deer were observed in relatively barren agricultural fields, which provided little to no cover. All deer were sighted in, or adjacent to, woodlots. Major concentrations were noted in north-northeast sections that roughly parallel Interstate 90 and west and south of Sugar Grove in the far southwestern corner of the county (Fig. 1). Deer-vehicle accidents are common along I-90, near areas of deer concentration (INHS, unpubl. data) and deer damage complaints were recently received by the IDOC from landowners near Big Rock, in the southwest corner of Kane County (Garrow, IDOC, pers. commun.).

Age specific fetal rates

Deer collected during herd reduction on the Ned Brown Preserve (NBP) continued to provide an opportunity to track interannual changes in age specific productivity. A reduction in deer density is expected to increase food availability for the residual survivors. The higher nutritional plane available to

does should be reflected in higher age specific fetal rates.

We expect that the number of females collected from the NBP in FY88 will be considerably lower than in FY87. Fifty-eight does were removed between 1 January - 15 April 1987. One fawn that used residential areas south of Rt. 72 was pregnant with a single fetus. All 9 yearlings had conceived, although only 1 had twin fetuses. Among 34 adult females, less than half (44%) had twins. Fetal rates of 0.07 (fawns), 1.11 (yearlings), and 1.38 (adults) did not indicate a major change in fetal rates over previous years (Table 3).

Nutritional assessment of deer herds in NE Illinois

Field work was completed in late FY86 on major segments of nutritional assessment studies. In FY87, we continued to evaluate condition of deer collected in the Ned Brown Preserve. Relative condition will be used to evaluate interannual changes under a regime of lowered herd density.

Michigan State University finished tissue and marrow laboratory analyses in late spring 1987. These data were stored on a computer data base; data will be analyzed and results reported during FY88.

Dr. Bruce Watkins, former nutritionist at Brookfield Zoo and cooperator on the nutrition segments of our program, now resides in Durango, Colorado. He is responsible for drafting 2 of the 4 manuscripts that will be produced on the nutritional assessment. Dr. Watkins has indicated that first drafts will be completed in January 1988.

Helminthic and Protozoan Parasite Analyses

Fecal pellets were collected from deer carcasses examined from 1983 through 1985. INHS subcontracted Mr. Jose Cisneros to analyze 270 fecal samples for helminthic and protozoan parasites by fecal flotation. Fecal samples from deer > 1 year old were stratified by location and season of collection. Samples had been frozen for periods of 1 to 3 years, which apparently induced rupture of parasite eggs and oocysts. This factor, combined with inherent weakness of the fecal flotation technique, may have contributed to relatively low detection of parasites. Parasites (eggs, first stage larvae, oocysts) were detected in 74 (28%) samples. Cisneros concluded that low prevalences of helminthic and protozoan parasites indicated that deer examined were not heavily parasitized nor were parasites viewed as a threat to the general deer population in terms of parasitic infection (Appendix A).

Reconstruction of Busse Woods Herd Age Structure

One assumption used in the population model was that herd age structure in Biological Year 1984 approximated an exponential distribution (after Moen et al. 1986). Complete reconstruction was not possible, although a large number of deer were examined during our road-kill study and during herd reduction. Tooth replacement (Severinghaus 1949) was used to separate deer into fawn, yearling, and adult age categories. Incisors from adults were were extracted and ages determined by cementum annuli (Matsons, Milltown, Mont.). We recognized that the deer examined were not a random sample and therefore may not have been

representative of the Busse Woods herd.

Mr. Brian Bogaczyk, a University of Wisconsin wildlife intern, at Max McGraw Wildlife Foundation during the summer of 1987, examined data collected by the INHS on ages of Busse Woods deer. He then reconstructed, as best as possible with incomplete data, herd age structure at the start of Biological Year 1984 (June 1984). Bogaczyk used Chi square to test the hypothesis that reconstructed age structure was not significantly different from an exponential age distribution:

For deer aged with highest certainty (rated A)

Males (N=29, age range 1-6 yrs, df=3, P = 0.132)

Females (N=80, age range 1-13 yrs, df=9, P = 0.335)

For deer aged with high certainty (A) and some error (B)

Males (N=34, age range 1-6 yrs, df=4, P = 0.097)

* Females (N=112, age range 1-13 yrs, df=9, P = 0.007)

For all deer aged

Males (N=37, age range 1-6 yrs, df=4, P = 0.219)

* Females (N=118, age range 1-13 yrs, df=9, P = 0.002)

* = ($P < 0.05$)

Bogaczyk concluded that the assumption of exponential age distribution was valid for all males, and for females whose ages were determined with high confidence. Based on results from these tests, we have no reason to alter our assumption that the Busse Woods deer herd approximated an exponential age structure at the start of Biological Year 1984.

Study No. 104-2: Deer Range Evaluation for Metropolitan Northeastern Illinois

Changes in land use--deer habitat insularity

We believe that the Ned Brown Preserve typifies what most county preserves will eventually become--isolated sanctuaries among intensive suburban development. The various preserves in the Cook County Forest Preserve system are presently in different stages of urban insularity. Changes in insularity are most often unidirectional with sites becoming more isolated with time. The preserve system, as a whole, is shifting toward a state of higher insularity as currently seen at the Ned Brown Preserve. The study of changes in land use, and how these changes influence deer ecology, is an essential consideration for urban deer management.

We selected a study site that extended 5 km in each direction from the NBP boundaries, (dimensions 15 X 15 km). Black and white aerial photographs of the study area were purchased (Chicago Aerial Survey, Des Plaines) for years 1949, 1964, 1970, and 1985. Individual prints were superimposed and taped/glued into composite pictures. A lighted image enlarger was used to classify features. Features were classified by 1-ha cell units based on Universal Transverse Mercator (UTM) coordinates. Each cell was classified by: 1) development, 2) vegetation, 3) water, and 4) roads.

Geographic Information System (pMAP, Spatial Information Systems, Inc., Omaha) software was used for data analyses. The pMAP program was favored over the INHS PRIME in Champaign because it was compatible with our field office personal computer.

Originally we intended to use the INHS Prime system. The Prime was abandoned because it was logistically difficult for field station personnel to become familiar with, and schedule access on the system. The pMAP program has less analytical and graphics capabilities, but is a sufficient alternative for spatial analysis problems.

Classification of cells required approximately 5 months and was completed in early September 1987; data entry and verification required 6 weeks and were completed in September 1987. Preliminary summaries are presented in this report to show progress. More complex analyses and data manipulation with pMAP will be initiated in the fall of 1987. The 4 overlays are treated separately in this report, although they will eventually be integrated by computer analyses.

The "development" overlay is most revealing (Table 4). In 1949, 83% of the study area was undeveloped with 10% low density housing (1-2 house units per cell). All other development categories (medium and high density housing, large buildings/paved areas, and construction) totalled 7% of the landscape. Most development was centered in the older community of Arlington Heights; villages of Elk Grove Village and Rolling Meadows were not present. In 1985, these relationships had significantly reversed with only 25% of cells remaining undeveloped (Ned Brown Preserve included in this total) and 5% in low density housing. Intensive development dominated 70% of landscape in 1985.

Analyses of roads follows a similar pattern. Cells with no

roads in 1949 (78%) decreased to 44% by 1985 (Table 5). This change resulted almost entirely from an increase in secondary roads from 1949 (10%) to 1985 (44%).

Agricultural dominated landscape in 1949 (80%) declined to 5% by 1985 (Table 6). Agriculture is subset of the "no development" classification (development overlay), which, as previously stated, declined from 83 to 25% during this same period. Urban development clearly supplanted rural landscape. Increases in grass (5-29%) and mixed vegetation (14-40%) resulted primarily from ornamental landscaping in residential areas and suburban community recreation facilities.

Small changes in percentage of water resources are probably more significant than similar changes among the other 3 classification types. A slight increase (from 2 to 5%) in shoreline/open water was accompanied by a small decline (from 8 to 4%) in streams. Cells classified as "no water" varied by small amounts (86% - 92% - 89% - 90%) (Table 7).

Land-use in northwest Cook County near the Ned Brown Preserve has dramatically changed from an 1949 agriculture dominated rural landscape into a highly developed residential, commerical, and corporate center in 1985. Villages that currently ring the Ned Brown Preserve rest on property that was unincorporated in 1949. Even the Ned Brown Preserve has changed internally--over half of the preserve was agricultural land in the late 1940's. Future analyses will document these changes in greater detail and will relate their importance relative to deer habitat corridors, isolation of herds, and barriers.

Effects of deer on forest vegetation

Vegetation analyses for 1987 continued with evaluations of: 1) changes in plant composition, 2) percent cover and stem densities of plants <1 m, 3) densities of shrubs and saplings >1 m and <10.2-cm-DBH, and 4) percent canopy closure. The former 3 analyses were conducted along permanent 20-m transects established in 1985 (Witham and Jones 1986), and in 4-year-old deer exclosures and adjacent control plots. Techniques were identical to those used last year. Horizontal foliar densities (HFD) were not measured during 1987. A lack of "sensitivity" to small differences in understory foliage of mature second growth woodlots precluded annual determinations of HFD. The technique may be refined for later use in woodlots where large tree trunks obscure the density profile board. However, HFD data from previous years have been stored on our microcomputer, and statistical comparisons among the 4 Busse woodlots will be presented in future progress reports.

Sampling of forest vegetation was reduced during FY87. However, 2 additional analyses were initiated this year: 1) plant phenology measurements in Busse Woods South-Northwest Section (a minimally browsed woodlot) to determine "peak" understory species richness, percent cover, and density. This peak could be used to standardize time of sampling each spring in order to improve validity of inter-annual comparisons. And 2) evaluation of elms (*Ulmus rubra* and *U. americana*) damaged by deer in Busse Nature Preserve.

The following sections report 1987 results and comparisons with descriptive means and relative values of 1984-86 data.

Potential trends over time and vegetative differences among woodlots are discussed. Transfer of large vegetation data sets from the CYBER 175 to the IBM 3081 (VMD) and development of appropriate statistical analyses have been facilitated by consultation with, and assistance from, the University of Illinois, Department of Statistics. Vegetation data (i.e., percent cover, density, etc.) for 1987 will be combined with 1984-86 data sets, and statistical comparisons among years and areas will be presented in future progress reports.

Percent Cover and Density of Plants <1m

All sites were sampled during mid - late May 1987. Based on time of year, 1987 results were more directly comparable with 1985 data (late May - early June) than with 1986 data (April - early May). Spring 1987 was drier than previous years (Jones, pers. obs.), and swampy/marshy areas, common in the north Busse woodlots, remained dry until late summer. The effect of differences in rainfall on understory vegetation growth may influence subjective comparisons between 1985 and 1987. Future job progress reports will analyze relationships between plant cover, plant density, and weather variables during months of sampling.

Busse Exclosure and Control Plot

Spring ephemerals (i.e., adder's tongue, Erythronium albidum) had declined in stature and numbers by late May. This decline led to a reciprocal effect on total plant density and percent cover between Busse exclosure and control plots (Tables 8, 9). Higher stem densities in the control plot were due to presence of

large, multi-stemmed patches of wild garlic (Allium canadense), wild leek (A. tricoccum), sedges (Carex spp.), and grasses. Although numerous, these latter species added little to total percent cover in the control. Higher percent cover was recorded for the exclosure (Table 9), in which broad-leaved herbs [i.e., enchanter's nightshade (Circaea quadrisulcata) and woodland knotweed (Tovara virginiana)] and woody species were more prevalent.

Density of woody species was marginally higher in the exclosure for the first time in 4 years. Numerous woody sprouts (Ulmus sp. in 1986) in the relatively barren control plot accounted for higher densities during past years. Visual inspection provided considerable evidence of past deer impact upon woody vegetation within Busse control plot. Woody basal sprouts have gained considerable stature in the exclosure, but are essentially lacking on the control site. Also, lack of competition, minimal use by deer, and microenvironmental differences (i.e., soil moisture, leaf litter depth, etc.) have provided suitable conditions for proliferation of grasses and sedges on the control plot.

Busse Woodlots

The 4 larger woodlots of the Ned Brown Preserve (Fig. 2) were sampled similarly to 1986 (along permanently-marked transects). Total plant densities for 1987 were lower in 3 woodlots due to time of sampling. However, Busse Nature Preserve had higher densities of herbaceous species and notable increases in grasses and sedges in 1987. Higher herbaceous densities in the nature preserve were due to an increase in total number of species and

densities of false nettle (Urtica gracilis) and enchanter's nightshade (Circaea quadrisulcata). This increase in understory vegetation, even though of a weedy nature initially, can be viewed optimistically as a positive trend and is presumably related to reductions of deer densities. Also, white trillium (Trillium grandiflorum) was observed for the first time along a permanent transect.

General trends in stem densities and percent cover were consistent with those observed in 1985 and 1986. The lowest values for these parameters were in Busse Woods North and Busse Nature Preserve, respectively (Tables 10, 11). Busse Woods South-Southwest Section remained highest in stem density and percent cover. Density and percent cover of woody species remained higher for both Busse South woodlots (BWS-SE and BWS-NW) than the northern woodlots (BWN and BNP). Woody, and all other, understory species were more vigorous in the south woodlots than in the once heavily-browsed BWN and BNP woodlots.

Des Plaines Exclosure and Control Plot

As in previous years, density and percent cover values in the Des Plaines exclosure and control plots were lower than those reported for Busse exclosure and control. The Des Plaines exclosure and control plots are within a predominantly sugar maple (Acer saccharum) woodlot with limited sunlight penetration into the understory. Reduced sunlight and well drained soil inhibit the proliferation of grasses and sedges. Absence of grass-like species eliminates the inverse relationship between percent cover and density totals reported for the Busse exclosure

and control plot.

Comparative values and trends on the Des Plaines sites remained consistent with past years (Tables 12, 13), except that herbaceous cover was higher in the exclosure in 1987. Totals for both measurements were higher in the exclosure than in the control plot due to notably higher values for woody species. Sugar maple was rare in the control plot, but essentially dominated in the exclosure (0.1% cover and 0.1 stem/m2 versus 2.9% cover and 3.1 stems/m2, respectively). Additionally, wahoo (Euonymous atropurpurea), gooseberry (Ribes sp.), and poison ivy (Toxicodendron radicans) were less abundant and less robust in the control plot.

The herbaceous component of the understory had higher stem densities in both areas in 1986 and 1987 and remained the major vegetative constituent in the area available to deer. Numerous leafless stems of jack-in-the-pulpit (Ariseama triphyllum), characteristically browsed by deer, were observed in the control plot. However, garlic mustard, a weedy exotic, proliferated in the Des Plaines exclosure and may eventually shade out more desirable native species.

Plant Phenology Analyses

Five permanent transects (20m) and 10 quadrats (1m2, two per transect) were randomly selected in Busse Woods South-Northwest Section (BWS-NW) to evaluate the chronology of appearance, decline, and disappearance of understory plants <1 m during spring - summer 1987. BWS-NW was selected because of minimal deer browsing damage and the likelihood that this site displayed understory characteristics formerly typical of Busse north

woodlots. Percent cover and density were sampled on the following dates during 1987: 20 April, 1 May, 11 May, 22 May, 16 July, and 24 August. Sampling techniques were identical to those used previously to determine percent cover and stem densities.

Total stem density values were highest on 20 April and 1 May but declined thereafter (Table 14). Total percent cover increased to 22 May, with notable decreases apparent on 16 July and 24 August (Table 15). Density of herbs declined rapidly between samplings, yet percent cover peaked on 11 May. The decrease in density was due to the decline of small, densely-clumped spring ephemerals--adder's tongue, spring beauties (Claytonia virginica), toothwort (Dentaria laciniata), etc. The mid-May peak in percent cover represented the annual peak of broad-leaved herbs such as solomon seal (Smilacina racemosa), enchanter's nightshade (Circaea quadrisulcata), and woodland knotweed (Tovara virginiana).

Woody species density and percent cover were highest on 22 May and 16 July. Differences between woody stem densities were small, as was expected because only the inclusion of new woody sprouts would increase stem numbers in repeatedly sampled quadrats. However, the smaller woody plant values for August were due, in part, to leaf drop by hawthorn (Crateagus spp.) saplings and the browsing of virginia creeper (Parthenocissus quinquefolia) foliage by deer--browsed stems were not included in any density values. Grasses and sedges reached maximum density on the last May sampling. Due to their generally clumped growth form, the percent cover expressed by grasses and sedges

fluctuated little.

Peak values of percent cover, stem density, and number of species indicate that the optimal time to sample woodland understory vegetation is mid to late May. Sampling at this time facilitates appraisal of both woody species and spring ephemerals. Unfortunately, spring weather plays a major role in the phenology of vegetation. The decision on when to initiate spring sampling should be based on field and weather conditions, yet an intuitive and subjective decision is required of the field investigator. The optimal period seemingly corresponds with 1) the presence (but decline) of spring flowers and 2) the nearly complete development of leaves on shrubs and small saplings (Jones, pers. obs.). Use of these two simple understory characteristics to determine the onset of sampling could yield more comparable data for evaluating trends in vegetation over a series of years.

Densities of Shrubs and Saplings >1m

Only Busse Nature Preserve was sampled for densities of shrubs and small saplings during August 1987. The number of samples and sampling techniques (5 x 5 m quadrats centered around endpoints of permanent transects) were identical to last year.

Differences reported between 1985 and 1986 were similar to those observed between 1986 and 1987. Estimated stem densities for the <2.5-cm-DBH (diameter at breast height) size class and all standing dead/leafless stems decreased over successive years (Table 16). Lack of woody replacements <1 m, death of additional plants in the <2.5-cm-DBH class, and growth of borderline individuals into the 2.5 - 10.2 cm size presumably led to the

decrease in the smaller size class. Numbers of dead stems per unit area most likely decreased due to continual decomposition and collapse as well as stems being physically knocked down by deer, humans, wind, large falling trees, etc. Stem densities for the 2.5- to 10.2-cm-DBH group have fluctuated among years but remained consistently higher than the smaller DBH class. Heavy deer browsing pressure prior to 1985 may have caused the large number of dead saplings recorded for that year. However, the decline of leafless stems was substantially higher than the rate of decrease for live plants <1 m, suggesting reduced mortality among shrubs and saplings after 1985.

Dominant species were similar to last year (Table 16). Sugar maple, ironwood (Ostrya virginiana) and ash (Fraxinus spp.) had the highest densities of the <2.5-cm saplings. Dominant species in the larger DBH class included: ironwood, basswood (Tilia americana), elms, and ash.

Elm Sapling Damage Analyses

Damage to saplings was first observed in the northwest corner of Busse Nature Preserve after the winter of 1985-86. Damage was observed again in the late winter of 1986-87. Species affected were elms; primarily slippery elm (U. rubra) and a few american elms (U. americana). The deer-caused damage was characterized by bark stripped from the main trunks of most saplings and from the roots of some larger elms. Deer also used their incisors to scrape away the inner cambium after the bark had been peeled and consumed. Many young trees were "girdled," and several were completely stripped of bark to a height of 150 cm.

Most damaged trees (>90%) were concentrated in a small portion (≤4 ha) of the nature preserve. However, estimated density of elms was greater for this area; 15 additional 25-m2 quadrats were used to evaluate shrub and sapling densities in the NW corner only. Estimated density values (stems/ha) for elms <2.5 cm DBH were similar to values for all of Busse Nature Preserve (Table 16). The density of 2.5- to 10.2-cm-DBH elms was higher in the NW corner, but was reduced due to death of damaged trees.

A total of 256 damaged elms was found during March 1987. Each was marked and the CBH (in mm) and species were recorded. In August, 250 of these trees were relocated; circumference measurements and species identification were repeated. Additionally, the extent of damage and ultimate fate of each tree were evaluated. Bark samples were collected from 10 damaged elms and from several adjacent species. Samples were collected from 10 hawthorns, 5 wild black cherries (Prunus serotina), 5 box elders (Acer negundo), 5 hickories (Carya spp.), and 5 basswoods.

These bark samples are currently being analyzed for percent moisture, crude protein, total energy, and concentrations of specific sugars at the INHS Analytical Chemistry Laboratory. The chemical analyses should provide further information on this observed species specific damage by deer.

Canopy Closure Analyses

Sampling techniques, initiated during the summer of 1986, were repeated in August 1987. Methods were described in Witham and Jones (1986) and are similar to those used by Hays et al. (1981). Canopy photographs were taken with an 80-mm lens in 1987 to

eliminate peripheral distortion inherent in slides taken with a 50-mm lens in 1986. Ektagraphic slides were taken at 50 random locations in each of the 4 Busse woodlots.

Canopy slide analyses will be completed in the fall 1987. Percent canopy closure will be compared between areas, and conclusions on effects of shading on understory differences and regeneration will be presented in future progress reports.

Future Activities

1) Data entry, analysis and summary will dominate vegetation-related activities for August - December 1987. Data for 1987 will be added to data sets for 1984-86 and statistical comparisons among years and areas will be conducted.
2) Field work will resume in May 1988 with understory sampling along permanent transects and in exclosures. Other activities will include sampling Busse Nature Preserve and Busse Woods South-Northwest Section to evaluate trends in shrub and sapling densities, enumerating elms damaged by deer in BNP during the winter of 1987-88, and, possibly, a re-evaluation of canopy tree importance values in all 4 Busse woodlots.

Study No. 104-3: Management Strategies and Implementation of Experimental Control of Urban Deer

Deer-vehicle accidents

Analyses of deer vehicle accidents in northeastern Illinois were continued in FY87. Two sets of data were updated: 1) Illinois Department of Transportation (IDOT) records for deer-vehicle accidents reported on state numbered highways, and 2) cost determination of deer-vehicle accidents based on questionnaires sent to accident victims investigated by the Cook County Sheriff's Police (CCSP). Methods used have been previously described (Witham and Jones 1986). We continue to believe that the CCSP deer-vehicle accident records are the most feasible means for tracking interannual trends in the economics of deer-vehicle accidents in northeastern Illinois. Cook County Highway Department has made CCSP records available annually.

Average cost of deer vehicle accidents

Questionnaires were sent to 126 individuals that struck deer with vehicles in unincorporated Cook County during 1986. Ninety seven (77%) usable responses were received and were summarized (Table 17).

Average total cost of deer-vehicle accidents in 1986 ($1480.22) was 13.4% above the mean estimate for 1985 ($1306.22), slightly less than annual rate of increase between 1984 and 1985 (15.4%). The relationship among cost-categories was similar for 1985 and 1986. The major cost was vehicle repair, which accounted for 92% of total costs during both years. Large standard deviations/variability characterized all estimates.

Non-repair cost-categories followed identical ranking between years:

substitute vehicle > lost wages > medical > towing > other

No human deaths resulted from deer-vehicle accidents in Cook County during either 1985 or 1986. If, and when, a fatal accident occurs, it will substantially increase non-repair costs and may be difficult to incorporate into total cost estimates because of subjectivity. The $400,000.00 estimated value for a loss of human life by vehicle accident in a Michigan survey in 1977, increased mean cost of deer-vehicle accidents from $571.00 to $648.00 (Hansen 1983).

Regional trends in deer vehicle accidents

The IDOC provided deer-vehicle accident records accumulated by the Illinois Department of Transportation. A summary of IDOT records from 1978 through 1986 show highly significant exponential trends in deer-vehicle accidents for Cook ($F=97.6$, $P=0.0001$), DuPage ($F=42.5$, $P=0.0006$), Kane ($F=167.2$, $P=0.0001$), and Lake ($F=71.4$, $P=0.0002$) counties (Table 18).

The economic significance of this increase in deer-vehicle accidents can be seen by multiplying average cost of a deer-vehicle accident for the respective years (previous section) by total number of recorded accidents in the 4-county study area for 1985 and for 1986. The difference in total cost of deer vehicle accidents on state-numbered highways between 1985 ($937,866.) and 1986 ($1,360,671.) represents an annual increased economic loss of $422,805.00.

Experimental herd reduction: Ned Brown Preserve (Busse Woods)

A pilot study to reduce and control herd size in the Ned Brown Preserve was continued during FY87. The program was initiated in FY86 in cooperation with the Illinois Nature Preserves Commission, Cook County Forest Preserve District, and IDOC. The principal objectives of herd reduction are to: 1) reduce deer browsing on Busse Woods Nature Preserve to a level that enables regeneration of the forest understory, 2) significantly reduce deer-vehicle accidents on adjacent highways, and 3) improve the average physical condition of deer inhabiting that area.

Modeling herd reduction on the Ned Brown Preserve

Deer were collected from areas of the Ned Brown Forest Preserve north of Rt. 72, on and adjacent to Busse Woods Nature Preserve; 142 deer were removed between 1 October 1986 and 10 April 1987 (Table 10). Adult and yearling females (N = 54) were selectively removed with priority over other sex and age classes. Mature males were rarely observed in the collection area after the autumn breeding season.

We continued to use POPII (Fossil Creek Software, Fort Collins, Colorado) to model herd demography and to predict reductions necessary to control herd size (see description of POPII in Witham and Jones 1986). Results presented in the present report are extensions of analyses presented in the FY86 Annual Report. The program was adjusted to include FY87 reproductive parameters (see fetal rates, Table 3) and sex and age specific removals (Table 19). Mortality rates were held

constant among years.

In the FY86 Annual Report we presented results from simulations based on 2 initial herd sizes. One represented estimated deer numbers for areas north of Rt. 72 (north half of the Ned Brown Preserve), and the other simulation was for all deer on the Ned Brown Preserve. The separation of Busse Woods North was useful for determining the initial number of deer to be removed because all deer were removed from this site. However, there is active interchange by deer between north and south sections of the Ned Brown Preserve--for this reason all deer on the Ned Brown Preserve will be treated as one unit.

The primary objective to reduce deer density at Ned Brown to 4-8 deer km2 (10-20 deer mi2) was achieved in FY86. End of year abundance (May 1987) was estimated at 76 deer (~16 deer/mi2) (Table 20). The impact of deer reduction on sex and age classes can be generalized as follows: 1) almost 2/3 (61%) of all adult females, 2) 1/3 (34%) of all adult males, and 3) 3/4 (78%) of all subadults were removed (Table 21).

Sex and age pyramids were constructed for each year of study (Fig. 3). Each pyramid represents the herd status at the beginning of the biological year following reproduction. Generalizations drawn from these data were:

1. That herd size has dramatically decreased, particularly over the last 3 years (Fig. 4).
2. That age structure has become much younger.
3. That ratio of adult males to adult females has increased (Fig. 5).
4. That recruitment of age class 1 (fawns) in the population

has been substantially reduced.

Future activities

Deer numbers on the Ned Brown Preserve north of Rt. 72 will be reduced to approximately 4 deer km2 (~10 deer/mi2). No deer will be removed south of Rt. 72. This area has maintained 35-50 deer annually without human intervention. We estimate that a total of 37 fawns was produced on the entire Ned Brown Preserve at the beginning of Bio Year 87 (June 1987). Reduction of the herd to ~4 deer/km2 will require that 50-60 deer be removed in FY88. Occurrence of a severe winter that increases deer mortality would expedite this process and could reduce the number of deer needed to be removed by project personnel.

Disposition of deer removed from the Ned Brown Preserve

Fourteen deer were captured with rocket nets; 3 subadults were euthanized and the remaining 11 deer were transported and released on the Fifth Army Training Area near Joliet. All other deer were shot by professional marksmen as described previously (Witham and Jones 1985). Ten of these carcasses were used by the IDOC for forensics. Venison from 52 deer was processed by a commerical meat processor and donated to the Greater Chicago Food Depository, a not-for-profit organization that distributes food to the indigent of Chicago. Postmortem examinations were performed and data collected on all carcasses.

Donation of venison to charitable organizations

Donation of venison to the Greater Chicago Food Depository was developed as an experimental program. The effort was

sucessful as a pilot project but needs refinement to be logistically feasible as a permanent program for disposal of surplus deer. The major problem is the requirement to have all carcasses processed for human consumption by a state licensed meat packing facility. Difficulties from this are:

1. Only 2 state licensed facilities in northeastern Illinois will process deer carcasses--none is located in Cook County.
2. Cost for processing by a packing facility is about $50.00/deer regardless of size. The majority of deer are less than 120 lb live weight and produce relatively small (generally 30-45 lb) quantities of actual meat.
3. Extensive preparation/handling of carcasses is required by project personnel prior to delivery to packing facility.
4. Facilities must be available to temporarily hang and cool carcasses prior to transport to packing facility.

The requirement for all deer to be processed in a state licensed packing facility needs to be altered. Current requirements necessitate excessive labor subsidization by state personnel. We suggest that the IDOC:

1. Introduce legislation to amend the Good Samaritan Food Donor Act to include the donation of field dressed carcasses of wildlife.
2. Survey wildlife carcass disposal policies of other states.
3. Survey legislation that protects other state wildlife agencies from liable suits when donating carcasses for human consumption to charities.
4. That options identified in #2 and #3 be reviewed and a new IDOC policy on carcass utilization/disposal be formulated and enacted.
5. That the INHS Urban Deer Study be given permission to develop an alternative experimental system where field dressed carcasses are given to charitable organizations.

Cost-effectiveness of deer removal techniques

Considerable interest has been expressed for cost evaluation of various deer removal techniques (requests from Colorado, Michigan, and Connecticut). We continued to collect cost-efficiency data during herd reductions in the Ned Brown Preserve. However, we have not summarized the entire data set. We expect to complete these analyses in FY88.

Monitoring of radio-collared deer

During January and February 1987, 19 deer were rocket-netted, transported to the Joliet Army Training Center (JATC), and released in Cantigny Woods (Fig. 6). Ten does (6 fawns, 1 yearling, and 3 adults) were radio-collared prior to transport. Four radio-collared does were present on, or near, JATC prior to the winter of 1986-87; 2 from December 1984 relocations and 2 from drive-net operations in March 1986. A total of 44 deer has been relocated to JATC (Table 22); 21 were radio-collared does.

Fourteen does were monitored on a biweekly or monthly basis between August 1986 and July 1987 (excluding September and November 1986). Telemetry data were entered on our IBM PC/XT and analyzed via the TELEM program (written by Dr. Gregory Koeln, DU Inc. and adapted for personal computers by the Geogr. Resour. Ctr., Univ. Missouri-Columbia). Data required for analyses included compass bearings for triangulation, deer identification numbers, date of triangulation, and Universal Transverse Mercator (UTM) grid coordinates of known telemetry locations. TELEM produced UTM grid locations for each radio-telemetry session, distances travelled between successive locations (i.e., minimum,

maximum, and mean distances), geometric center of activity, and several calculations of home range.

The 4 deer remaining in the JATC area prior to relocations in January-February 1987 exhibited maximum movements of < 1.5 km between successive triangulations (Table 23). Doe #550 was an exception; during October - December 1986 she moved from Hoff Woods (a hunted woodlot) to a more isolated and nonhunted portion of the Joliet Army Ammunition Plant (JAAP), east of the 4-lane Route 53. She returned to Hoff Woods during January 1987. This doe resumed her annual spring trek (Witham and Jones 1986) of approximately 15 km ESE to a small woodlot near Wilton Center. Presumably, these moves during May (1987) and June (1986) were for purposes of fawning in a densely-wooded and more secluded area. However, successive movements of doe #550 prior to, and after, this eastward trek were limited (range = 0.3 - 2.0 km) and more characteristic of the sedentary nature displayed by the other 3 does translocated > 1 year ago.

Movements of new transplants were limited after an initial dispersal from the release site; Seven (5 fawns and 2 adults) of 10 moved > 2 km within 2 months post-release. Thereafter, movements between successive locations were smaller for most animals. Two does (1 adult and 1 fawn) remained within 1 km of the release site.

Unidirectional dispersals or "homing" movements were not evident for the most recently translocated Cook Co. deer, which is consistent with other studies on post-release movements of relocated animals (Dahlberg and Guettinger 1956, Hawkins and Montgomery 1969). Average straight-line movements in the JATC

area during August 1986 - July 1987 were 1.3 km and were considerably smaller than values reported for translocated, white-tailed deer in southern Illinois (Hawkins and Montgomery 1969) and black-tailed deer (O. hemionus columbianus) in California (O'Bryan and McCullough 1985). The sedentary nature of Busse and Des Plaines deer and favorable conditions (i.e., adequate habitat requirements, minimal human disturbance, and apparently low level of competition with native deer) on JATC and adjacent properties presumably precluded long-distance dispersals after relocation.

Among 21 radio-monitored does, 6 (29%) died within 6 months after release (Table 24). Six of 10 (60%) animals transported > 1 year ago have died or been killed. Causes of mortality included: trap and transport associated stress (1 adult), deer-vehicle collisions (2 fawns and 1 yearling), hunter-killed (2 adults and 1 yearling), and unknown causes (1 yearling). Also, 2 fawns lost collars within 4 months of release. Two of 10 does, transported in the winter of 1986-87, died within 1 month of release. Both carcasses were scavenged, and only radio-collars, tufts of hair, and few bone fragments remained. One (fawn #650) was reportedly struck by a car (Sgt. G. Wallace, U.S. Dept. Army, pers. comm.) Cause of death could not be determined for the second animal.

Mortality was highest for yearling does; all 3 transported during this study died within 3 months post-release. Mortality was 38% among adult does and lowest for fawns. Two of 10 fawns were killed by cars; however, 2 additional fawns lost radio-

collars, and their fates were undetermined. Four translocated males were hunter-killed in the fall of 1985; movements and fates of 19 bucks are unknown.

Small sample sizes precluded additional conclusions about age-specific mortality of does after relocation. However, percent mortality for all of our relocated does during the first year post-release was notably lower than values reported by other researchers. Hawkins and Montgomery (1969) reported 68% mortality (19 of 28) for southern Illinois white-tails within 7 months of capture and release. Mortality was 85% (11 of 13) for black-tailed deer transported from Angel Island, CA (O'Bryan and McCullough 1985). Much like the Angel Island relocations, human-related deaths, particularly deer-vehicle collisions, comprised a large proportion of deer deaths occurring within one year during our study. Survival is inevitably low for animals moved into strange surroundings that are open to public hunting and compartmentalized by major roads.

All locations and distances between successive locations are approximations. Accuracy and precision of radio-telemetry relocations in the JATC area have not been tested. The "hilly" terrain, heavily wooded areas along waterways, and the network of elevated high voltage lines may affect ground level bearing estimates. However, the primary objectives to evaluate survival and to monitor long distance dispersal or "homing" movements were achieved.

Management recommendations prepared for local and state agencies

Recommendations for a cooperatively supported new initiative

on urban deer management were submitted to the Illinois Department of Conservation and to the Cook County Forest Preserve District (Executive summary and text, Appendix B).

Recommendations for deer removal on O'Hare International Airport were submitted to the O'Hare Airport Aviation Safety Department and to the Chicago Animal Control (Executive summary and text, Appendix C).

Recommendations for donating venison to charitable organizations are included in the text of this report (see pages 25-26).

Study No. 104-4: Data Base Management, Analysis, and Reporting on Urban Deer Research

Data base management and analysis

Distance from Chicago to primary computer facilities in Champaign has influenced progress. We have continued to upgrade our micro computer facility in Chicago--specifically we have improved our analytical capabilities and have developed a highly usable library of books and reprints:

> Computer - the IBM PC field office was linked via modem/Watts line to the University of Illinois mainframe computer system in Champaign. The linkage will improve our ability to analyze large data sets that have been collected. Correspondence with University of Illinois statistical laboratory consultants can now be conducted by leaving messages on designated file space. Considerable time has been expended to learn different styles of communication protocol with the mainframe system. Ellen Brewer (INHS Economic Entomology) has provided essential information assistance.
>
> Library - we continued to use Bookends (Sensible Software, Oak Park, Michigan) software to cross reference literature by keywords, author, and title. The INHS librarians in Champaign regularly locate, copy, and forward requested articles, which are added to the field station reference literature. Bookends software operates on the Apple IIE personal computer.
>
> Geographic Information System - we have expanded our capability to analyze spatial data by using GIS (pMAP) and telemetry analysis (TELEM) software. The pMAP system will be particularly useful in developing deer and habitat distribution maps.

Because the INHS has no staff statistical consultant at this time, we have contracted services of the University of Illinois Statistical Consultants Laboratory to provide consultation. Considerable work has been completed on vegetation analyses. Future efforts will concentrate on processing the large volume of data collected under Job 104-1.

Data are variously preserved on the University of Illinois mainframe system and on IBM and Apple IIE compatible floppy diskettes. In most cases, hardcopies of data are retained in field office files.

Information dissemination

Project information has been disseminated through a wide range of mediums:

Professional/technical meetings

- Community Liason Committee, Dundee, fall 1986
- IDOC/INHS, winter 1987, Springfield
- IDOC/INHS/Cook County Forest Preserve District, Chicago, summer 1987

Presentations

- Governor's State University (Jones)
- Northeastern Illinois University (Jones)
- Northeastern Illinois University (Witham and Jones)
- Triton College (Witham)
- National Urban Wildlife Symposium (Witham)

News media and journalists

- Chicago television channels 2 (CBS) and 7 (ABC)
- Newspaper interviews- no exact account, est. 15
- Magazine journalists- In Vermont & Il. Game & Fish

Public

- Program provides wildlife extension services to public, no count has been made of number of annual contacts, estimated at 100 for FY87. Greatest frequency of requests involves disposal and claiming road-kill deer, damage abatement, injured and displaced deer, and Lyme Disease.
- Packet of reprinted information is typically sent to callers.

Popular articles/symposium proceedings

- Outdoor Notebook
- INHS Reports
- National Urban Wildlife Symposium Proceedings

Project reports

- o 4 quarterly reports
- o 1 annual report
- o 1 application for Federal Aid

(b) Target Date of Achievement: Final Report due 30 Sep 1989.

(c) Date of Accomplishment: On schedule

(d) Significant Deviations: None

(e) Remarks: Data sets on nutritional assessment, toxicology, and cost efficiency of removal techniques, projected to be analyzed and manuscripts drafted in FY87, were not completed. Data analyses and reporting will be prioritized during FY88.

Field evaluation of cost efficiency of deer removal by remote chemical injection will not be conducted.

(f) Recommendations: None

(g) Cost: Sub-Project VII-D: Biology, Ecology, and Management of Deer in the Chicago Metropolitan Area.

Job No.	Federal	State	Total
104-1	$ 18,472	$ 6,157	$ 24,629
104-2	30,786	10,262	41,048
104-3	24,629	8,210	32,839
104-4	49,258	16,419	65,677

LITERATURE CITED

Dahlberg, B. L., and R. C. Guettinger. 1956. The white-tailed deer in Wisconsin. Wisconsin Conserv. Dept. Bull. 14. 282pp.

Hansen, C.S. 1983. Costs of deer-vehicle accidents in Michigan. Wildl. Soc. Bull. 11:161-164.

Haw kins, R. E., and G. G. Montgomery. 1969. Movements of translocated deer as determined by telemetry. J. Wildl. Manage. 33(1):196-203.

Hays, R.L., C. Summers, and W. Seitz. 1981. Estimating wildlife variables. USDI Fish and Wildlife Service, FWS/OBS-81/47. 111pp.

Moen, A. N., C. W. Severinghaus, and R. A. Moen. 1986. Deer Camp. Cornerbook Press, Lansing, New York. 170pp.

O'Bryan, M. K., and D. R. McCullough. 1985. Survival of black-tailed deer following relocation in California. J. Wildl. Manage. 49(1):115-119.

Severinghaus, C.W. 1949. Tooth development and wear as a criteria of age in white-tailed deer. J. Wildl. Manage. 13:195-216.
Witham, J.H., and J.M. Jones. 1985. Urban Deer Study.

Witham J.H., and J.M. Jones. 1985. Cooperative Forest Wildlife Research: Urban Deer Study, Illinois Perf. Rep. Pittman-Robertson Proj. W-87-R-6, 30pp.

Witham, J.H., and J.M. Jones. 1986. Cooperative Forest Wildlife Research: Urban Deer Study, Illinois Perf. Rep. Pittman-Robertson Proj. W-87-R-7, 118pp.

Table 1. Number of deer observed on northern Cook County Forest Preserves during 3 consecutive winters, 1985–1987.

Location	Number of deer counted[a] 1985	1986	1987
Ned Brown			
N of Higgins	207	154	85
S of Higgins	46	36	33
Total	253	190	118
Indian Boundary			
Madison to North	8	4	2
North to Belmont	0	0	0
Belmont to Irving Pk	34	60	21
Irving Pk to Lawrence	21	23	29
Lawrence to Kennedy	38	30	35
Kennedy to Devon	16	6	7
Devon to Touhy	13	9	5
Totals	130	132	99
Des Plaines			
Touhy to Oakton	19	8	10
Oakton to Golf	21	21	13
Golf N to Central	30	25	28
Central N to Lake	53	106	91
Lake N to Palatine	60	53	29
Palatine N to Dundee	119	120	51
Dundee to Lake/Cook	73	53	47
Totals	375	386	269
North Branch			
N of Oakton	13	8	4
S of Oakton	7	4	8
Totals	20	12	12
Skokie			
Tri State S to Voltz	46	69	42
Lake/Cook S to Dundee	15	21	10
Dundee S to Willow	54	71	92
Willow S to Golf	12	46	26
Totals	127	207	170

[a] Counts from aerial surveys are minimum numbers of deer for a given area. They do not reflect absolute numbers because an indeterminable percentage of deer are not observed during a survey.

Table 2. Number of white-tailed deer observed on DuPage County Forest Preserves during 1985 and 1987 aerial surveys.

Forest Preserve	Number of deer counted 1985[a]	1987[b]	
Blackwell	14	13	
Burlington Park	0	0	
Churchill Woods	0	2	
Greene Valley	29	21	
Herrick/Danada	6	19	
Hidden Lake	7	13	} adjacent
Morton Arboretum		19	
McDowell Grove	0	1	
Pratt's Wayne	2	11	
Springbrook	0	0	
Timber Ridge	19	19	
Waterfall Glen	71	217	} adjacent
Argonne		30	
West Branch	23	22	
West DuPage	3	0	
Winfield Mounds	4	6	

[a] 16 February 1985, Cessna 172 fixed-wing

[b] 21-22 January 1987, Bell Long Ranger helicopter

Table 3. Fetal rates of deer collected from the Ned Brown Preserve, 1984-1987.

Female age class by year	N	Number of fetuses				Fetuses/N
		0	1	2	3	
1984						
1 year (fawn)	9	9	0	0	0	0
2 years (yrlg)	5	3	2	0	0	0.40
2+ years (adult)	13	2	7	4	0	1.15
1985						
1 year (fawn)	5	5	0	0	0	0
2 years (yrlg)	4	3	0	1	0	0.50
2+ years (adult)	9	0	4	5	0	1.56
1986						
1 year (fawn)	18	18	0	0	0	0
2 years (yrlg)	4	1	3	0	0	0.75
2+ years (adult)	42	4	9	25	4	1.69
1987						
1 year (fawn)	15	14	1	0	0	0.07
2 years (yrlg)	9	0	8	1	0	1.11
2+ years (adult)	34	2	17	15	0	1.38

Table 4. Percentage of 1 ha cells, classified by urban development, within a 225 km2 study site centered on the Ned Brown Preserve, northwest Cook County for 1949, 1964, 1970, and 1985.[a,b]

Development Classification	Year			
	1949	1964	1970	1985
No development	82.6	57.9	49.7	24.8
Low density housing	9.6	10.3	8.6	5.3
Medium density housing	3.6	6.1	8.0	14.9
High density housing	2.1	15.0	16.9	29.2
Buildings/paved areas	1.8	8.2	14.4	24.9
Construction	0.4	2.4	2.2	0.9
Unknown	0	0.2	0.1	0

a
No development- no development in 1 ha cell (includes agriculture)

Low density housing- 1-2 houses located in cell

Medium density housing- 3-4 houses located in cell

High density housing- 5 or more houses located in cell

Building/Pavement- contains at least one building and/or associated pavement (i.e., parking lots, runways, tennis courts, baseball diamonds, etc.)

Construction- at least 1/2 of cell is under construction

Unknown- development type cannot be determined (gravel pit included)

b
Buildings indistinguishable from houses were classified by housing density (# buildings/houses per cell)

Table 5. Percentage of 1 ha cells, classified by road type, within a 225 km2 study site centered on the Ned Brown Preserve, northwest Cook County for 1949, 1964, 1970, and 1985. 1985. (a,b,c)

Road Classification	Year			
	1949	1964	1970	1985
No roads	77.7	59.0	53.6	44.2
Secondary	10.4	30.8	35.0	43.8
Main	10.8	6.0	6.9	5.9
Major	0.0	1.2	1.4	1.6
Secondary/Main	1.1	2.6	2.4	3.6
Main/Major	0	0.3	0.3	0.6
Secondary/Major	0	0.2	0.3	0.4

a
Definitions:

No roads- no roads in cell

Secondary roads- all roads that are not main or major roads, including railroads

Main roads- 2 or 4lane roads that are > 5 km in length

Major highways- roads with ≥ 6 or more lanes

Secondary/Main- both types are located in cell

Main/Major- both types are located in cell

Secondary/Major- both types are located in cell

b
Driveways, gravel, and dirt roads were not classified

c
Roads under construction assigned type based on completion

Table 6. Percentage of 1 ha cells, classified by vegetation, within a 225 km2 study site centered on the Ned Brown Preserve, a northwest Cook County, 1949, 1964, 1970, and 1985.[a]

Vegetation Classification	Year			
	1949	1964	1970	1985
No vegetation	0.1	2.2	5.4	19.3
Agricultural field	79.9	41.5	24.9	5.2
Grass	5.1	24.5	25.1	29.0
Mixed vegetation	13.8	30.4	43.0	39.5
Closed canopy forest	0.9	1.3	1.6	6.4
Unknown	0	0	0	0.1

[a] Definitions:

No vegetation- no dominant vegetation in cell

Agricultural field- at least 1/2 of cell is agricultural field, or, pasture in association with agriculture

Grass- meadow or grass not associated with agriculture

Mixed vegetation- mixture of grass, shrubs, and trees (includes marsh vegetation)

Closed canopy forest- entire cell includes closed canopy woodlot

Unknown- type not distinguishable from aerial photograph

Table 7. Percentage of 1 ha cells, classified by water resource, within a 225 km2 study site centered on the Ned Brown Preserve, a northwest Cook County, 1949, 1964, 1970, and 1985.

Water Resource Classification	Year			
	1949	1964	1970	1985
No water	86.1	92.2	88.9	90.2
Stream	7.5	4.6	4.9	3.5
Shoreline	1.2	1.3	2.6	4.7
Open water	1.1	0	0.1	0.5
Marsh shoreline	4.2	1.9	3.6	1.2
Open marsh	0	0	0	0

[a]
Definitions:

No water- no identifiable water located in cell

Stream- segment of stream < 100 m in width in cell

Shoreline- interface between land and lake, pond, or river > 100 m width

Open water- entire cell is open water

Marsh shoreline- interface between land and marsh in cell

Open marsh- entire cell is marsh

Table 8: Densities (stems/m2) of plants <1 m in Busse exclosure and control plot, 1984-1987. N = 48 quadrats (1 m2) for each area each year.

Plant Type	1984(Aug.)		1985(May)		1986(Apr.)		1987(May)	
	BEX[a]	BCP[b]	BEX	BCP	BEX	BCP	BEX	BCP
Herbs	10.9 (12)[c]	7.5 (15)	72.8 (21)	40.0 (21)	136.3 (18)	68.8 (22)	25.4 (22)	38.3 (25)
Woody	1.0 (11)	1.8 (11)	1.6 (10)	3.5 (9)	5.0 (12)	9.1 (11)	1.8 (12)	0.8 (6)
Grass/ sedge	1.4 (1)	3.4 (1)	0.2 (2)	35.7 (5)	2.2 (2)	25.4 (3)	2.1 (2)	33.9 (2)
Other[d]	0.8 (1)	0.6 (1)	3.1 (1)	3.6 (1)	0.4 (1)	1.9 (2)	0.3 (2)	1.9 (3)
Total	14 (25)	14 (28)	78 (34)	84 (36)	144 (33)	105 (38)	30 (38)	75 (36)

a Busse Exclosure.
b Busse Control Plot.
c Minimum number of species shown in parentheses.
d The "other" category includes unidentifiable species, mosses and fungi.

Table 9: Percent cover of plants <1 m in Busse exclosure and control plot, 1984-1987. N = 12 line intercepts (20 m) for each area each year.

Plant Type	1984(Aug.)		1985(May)		1986(Apr.)		1987(May)	
	BEX[a]	BCP[b]	BEX	BCP	BEX	BCP	BEX	BCP
Herbs	1.8 (12)[c]	0.5 (12)	7.5 (17)	4.6 (16)	5.1 (12)	3.2 (15)	4.7 (19)	2.4 (22)
Woody	1.8 (11)	1.5 (8)	1.5 (10)	0.4 (7)	0.5 (7)	0.2 (4)	1.9 (11)	0.4 (5)
Grass/ sedge	0.3 (1)	1.8 (1)	0.2 (2)	0.8 (3)	0.1 (3)	0.4 (3)	0.1 (2)	1.6 (2)
Other[d]	0.5 (2)	2.0 (2)	1.2 (2)	1.7 (2)	T (2)	0.1 (2)	1.6 (3)	1.9 (3)
Total	4.4 (26)	5.8 (23)	10.5 (30)	7.5 (28)	5.6 (23)	3.9 (23)	8.3 (35)	6.3 (31)

a Busse Exclosure.
b Busse Control Plot.
c Minimum number of species shown in parentheses.
d The "other" category includes unidentifiable species, mosses and fungi.

Table 10: Percent cover of plants <1 m in the Ned Brown Preserve, CCFPD during May 1987 (sample unit = 20 m line intercept).

Plant Type	[a] BNP (N=25)	[b] BWN (N=25)	[c] BSN (N=15)	[d] BSS (N=15)
Herbaceous	1.9 (30)[e]	2.0 (24)	9.4 (25)	11.5 (25)
Woody	0.5 (14)	0.4 (12)	5.1 (17)	17.8 (17)
Grasses & sedges	0.7 (2)	1.1 (2)	0.8 (2)	0.1 (2)
Other[f]	0.8 (2)	0.8 (2)	0.7 (2)	0.3 (2)
Total	4.1 (48)	4.4 (39)	16.0 (46)	29.7 (46)

a Busse Nature Preserve
b Busse Woods North
c Busse Woods South-Northwest section
d Busse Woods South-Southeast section
e Minimum number of species shown in parentheses.
f The "other" category includes unidentifiable species, mosses and fungi.

Table 11: Density (stems/m2) of plants <1 m in the Ned Brown Preserve, CCFPD during May 1987 (sample unit = 1 m2 quadrat).

Plant Type	a BNP (N=50)	b BWN (N=50)	c BSN (N=30)	d BSS (N=30)
Herbaceous	41.8 (25)e	41.4 (28)	80.1 (19)	113.0 (24)
Woody	4.3 (17)	4.0 (13)	5.3 (17)	5.9 (14)
Grasses/sedges	46.5 (2)	16.2 (2)	12.0 (3)	0.2 (2)
Other f	1.2 (1)	0.7 (1)	0.7 (1)	0.9 (1)
Total	94 (45)	62 (44)	98 (40)	120 (41)

a Busse Nature Preserve
b Busse Woods North
c Busse Woods South-Northwest section
d Busse Woods South-Southeast section
e Minimum number of species shown in parentheses.
f The "other" category includes unidentifiable species, mosses and fungi.

Table 12: Percent cover of plants <1 m in Des Plaines exclosure and control plot, 1984-1987. N = 12 line intercepts (20 m) for each area each year.

Plant Type	1984(Aug.)		1985(June)		1986(May)		1987(May)	
	DPEX[a]	DPCP[b]	DPEX	DPCP	DPEX	DPCP	DPEX	DPCP
Herbs	T[c] (1)[d]	T (2)	1.0 (7)	0.9 (5)	2.0 (8)	3.7 (6)	1.6 (9)	1.1 (9)
Woody	1.7 (8)	1.1 (7)	6.1 (12)	1.7 (11)	5.1 (10)	0.9 (9)	5.9 (11)	0.8 (7)
Grass/ sedge	T (1)	0	0	0	T (1)	0	0.1 (1)	0
Other[e]	T (1)	0	0.2 (2)	T (1)	T (1)	T (2)	0.1 (3)	T (1)
Total	1.8 (11)	1.2 (9)	7.2 (21)	2.1 (17)	7.2 (20)	4.0 (17)	7.7 (24)	1.9 (17)

a Des Plaines Exclosure.
b Des Plaines Control Plot.
c Trace amounts (0 < T < 0.1%).
d Minimum number of species shown in parentheses.
e The "other" category includes unidentifiable species, mosses and fungi.

Table 13: Densities (stems/m2) of plants <1 m in Des Plaines exclosure and control plot, 1984-1987. N = 48 quadrats (1 m2) for each area each year.

Plant Type	1984(Aug.)		1985(June)		1986(May)		1987(May)	
	DPEX[a]	DPCP[b]	DPEX	DPCP	DPEX	DPCP	DPEX	DPCP
Herbs	0.2 (4)[c]	0.1 (2)	2.4 (9)	5.2 (4)	19.3 (9)	21.9 (8)	11.7 (11)	9.8 (9)
Woody	2.9 (6)	1.2 (6)	12.4 (9)	9.7 (13)	7.9 (11)	3.0 (11)	7.8 (10)	4.3 (11)
Grass/ sedge	0	0	0	0	0	T (1)	0	T (1)
Other[d]	0.3 (2)	T[e] (1)	5.8 (1)	0.3 (1)	1.0 (1)	0.9 (2)	1.8 (3)	0.7 (3)
Total	3 (12)	1 (9)	24 (19)	15 (18)	29 (21)	26 (22)	21 (23)	15 (24)

a Des Plaines Exclosure.
b Des Plaines Control Plot.
c Minimum number of species shown in parentheses.
d The "other" category includes unidentifiable species, mosses and fungi.
e Trace amounts (0 < T < 0.1 stem/m2).

Table 14: Densities (stems/m2) of plants <1 m in Busse Woods South - Northwest Section, 1987. N = 10 quadrats (1 m2) each day.

Plant Type	20 April	1 May	11 May	22 May	16 July	24 August
Herbs	123.8(14)[a]	122.0(14)	88.9(17)	46.7(16)	23.9(10)	11.6(8)
Woody	5.7(4)	4.6(14)	5.6(13)	6.8(14)	6.9(14)	5.0(15)
Grass/ sedges	0.2(1)	3.9(2)	3.3(1)	4.2(2)	3.2(2)	1.9(2)
Other[b]	1.8(1)	0.8(1)	1.5(1)	0.6(1)	2.3(1)	2.3(2)
Total	131.5(20)	131.3(31)	99.3(32)	58.4(33)	36.3(27)	20.8(27)

a Minimum number of species shown in parentheses.
b The "other" category includes unidentifiable species, mosses and fungi.

Table 15: Percent cover of plants <1 m in Busse Woods South -Northwest Section, 1987. N = 5 line intercepts (20 m) each day.

Plant Type	20 April	1 May	11 May	22 May	16 July	24 August
Herbs	4.9 (13)[a]	7.0 (17)	9.0 (18)	8.2 (17)	5.6 (12)	3.4 (6)
Woody	0.4 (5)	1.6 (9)	6.3 (13)	9.7 (13)	9.2 (16)	7.5 (14)
Grass/ sedges	0.1 (2)	0.1 (2)	0.2 (2)	0.2 (1)	0.1 (1)	T[c] (1)
Others[b]	0.8 (2)	0.8 (1)	1.1 (2)	0.8 (1)	1.3 (2)	0.9 (2)
Total	6.1 (22)	9.5 (28)	16.6 (35)	19.0 (32)	16.3 (31)	11.9 (23)

a Minimum number of species shown in parentheses.
b The "other" category includes unidentifiable species, mosses and fungi.
c Trace amounts (0 < T < 0.1%).

Table 16: Estimated shrub/sapling (>1 m) densities (stems/ha) in Busse Nature Preserve, 1985-87 (sample unit = 5 x 5 m quadrats).

Species	1985 (N=50)		1986 (N=50)		1987 (N=50)		1987[a] (N=15)	
	<2.5[b]	2.5-10.2	<2.5	2.5-10.2	<2.5	2.5-10.2	<2.5	2.5-10.2
Ostrya virginiana	96	200	120	368	104	296	0	27
Corylus americana	136	0	16	0	24	0	0	0
Acer saccharum	136	64	264	88	200	80	0	0
Crateagus spp.	104	48	64	64	64	32	0	80
Ulmus spp.	96	152	32	144	24	160	27	80(213[c])
Fraxinus spp	136	176	64	152	80	120	27	80
Tilia americana	56	288	112	288	48	256	0	0
Rhamnus cathartica	32	200	32	64	32	80	0	187
Prunus americana	32	8	8	0	0	0	0	0
P. serotina	16	0	16	32	16	32	0	27
Carya cordiformis	16	8	0	0	0	0	0	0
C. ovata	8	8	8	24	0	32	0	0
A. saccharinum	0	16	0	0	0	0	0	0
Quercus spp.	0	8	8	16	8	16	0	0
Euonymous atropurpureus	0	0	0	24	8	8	0	0
Cornus racemosa	0	0	24	0	40	0	0	0
Malus sp.	0	0	8	0	0	0	0	0
A. negundo	0	0	0	8	0	8	0	0
Viburnum rafinesquianum	0	0	8	0	0	0	0	0
V. prunifolium	0	0	0	0	0	0	53	0

cont.

Table 16:continued

Species	1985		1986		1987		1987[a]	
	<2.5	2.5–10.2	<2.5	2.5–10.2	<2.5	2.5–10.2	<2.5	2.5–10.2
Juglans cinerea	0	0	0	0	0	0	27	27
Lonicera sp.	0	0	0	0	0	0	0	27
Unknowns	0	0	32	0	0	0	0	0
Dead/leafless	2768	152	1056	88	648	56	427	213
Total live	864	1176	816	1272	648	1120	134	535

a Additional sampling in NW corner of Busse Nature Preserve (=area of many deer-damaged elm trees).
b Diameter at breast height (cm).
c Living elms + elms that died due to previous deer damage.

Table 17. Average cost of deer-vehicle accidents in Cook County during 1986, based on 97 usable returned questionnaires.

Cost Categories	1986 Mean	1986 St. Dev.	1985 Mean
Repairs	$ 1365.43	1774.35	1201.75
Towing	7.51	35.73	11.01
Medical	12.70	80.93	22.13
Lost Wages	22.16	115.82	18.63
Substitute Vehicle	71.21	213.56	45.18
Other expenses	1.59	46.35	7.52
Total	$ 1480.60		$ 1306.22

Table 18. Number of deer-vehicle accidents reported on state numbered highways in northeastern Illinois from 1978 through 1986 (Illinois Dep. Trans., unpubl. records).

	Year								
County	78	79	80	81	82	83	84	85	86
Cook	137	112	139	167	260	248	354	379	469
DuPage	20	19	19	20	23	31	50	58	76
Kane	24	34	36	36	55	68	80	81	124
Lake	66	50	53	73	105	126	157	200	250
Total	247	215	247	296	443	473	641	718	919

Table 19. Sex and age composition of deer removed by INHS from North Busse Woods between 1 October 1986 - 15 April 1987.

	Female			Male		
	Fawns	Yrlgs	Adult	Fawns	Yrlgs	Adult
Live Capture	4	0	2	5[a]	3	0
Lethal Removal[b]	31	14	38	28	10	7
Totals	35	14	40	33	13	7

[a] includes 3 male fawns that were livetrapped and euthanized

[b] does not include 3 deer that were shot and not recovered

Table 20. Estimated changes in deer numbers at the Ned Brown Preserve, northwest Cook County, for biological years 1984, 1985, 1986, and 1987.

Bio year[a]	June	May	% Growth
1984-85	378	251	0.5[b]
1985-86	380	173	-28.4[c]
1986-87	272	76	-58.5[d]
1987	113		

a
A biological year starts on 1 June and ends on 31 May of the following calendar year. Therefore the biological year 1984 starts on 1 June 1984 (entire 1984 fawn crop is included) and continues until 31 May 1985.

b
June 1984 to June 1985

c
June 1985 to June 1986

d
June 1986 to June 1987

Table 21. Estimated percentage of deer removed by sex and age classes during years, June 1984 - June 1987, for the Ned Brown Preserve, northwest Cook County.

Bio Year[a]	Sub-Adult (%)	Adult Male (%)	Adult Female (%)	Total (%)
1984-85	8.9	1.8	8.8	7.6
1985-86[b]	51.9	26.4	32.9	37.9
1986-87	77.9	34.4	61.0	60.7

[a] A biological year starts on 1 June and ends on 31 May of the following calendar year.

[b] Herd reduction was initiated during 1985-86.

Table 22: White-tailed deer transported to Joliet Army Training Center, December 1984 - February 1987.

Date captured	Area of capture	Sex	Age at capture	Markings	Method of capture	Method of transport
12/18/84	Busse[a]	M	Adult	ET#1[c]	Rocket net	Wood crate
12/18/84	Busse	F	Fawn	ET#2	Rocket net	Wood crate
12/18/84	Busse	F	Fawn	ET#3	Rocket net	Wood crate
12/18/84	Busse	M	Fawn	ET#4	Rocket net	Wood crate
12/18/84	Busse	M	Fawn	ET#5	Rocket net	Wood crate
12/18/84	Busse	F	Fawn	RC#550[d]	Rocket net	Wood crate
12/18/84	Busse	M	Fawn	ET#7	Rocket net	Wood crate
12/18/84	Busse	F	Adult	RC#600	Rocket net	Wood crate
12/18/84	Busse	F	Adult	RC#790	Rocket net	Wood crate
12/18/84	Busse	F	Adult	RC#530	Rocket net	Wood crate
12/18/84	Busse	F	Yearling	RC#490[e]	Rocket net	Wood crate
12/18/84	Busse	F	Yearling	RC#800[e]	Rocket net	Wood crate
12/19/84	Des Plaines[b]	M	Adult	ET#14	Rocket net	Wood crate
12/19/84	Des Plaines	M	Adult	ET#15	Rocket net	Wood crate
12/19/84	Des Plaines	M	Adult	ET#16	Rocket net	Wood crate
12/19/84	Des Plaines	M	Yearling	ET#17	Rocket net	Wood crate
12/19/84	Des Plaines	M	Fawn	ET#19	Rocket net	Wood crate
12/19/84	Des Plaines	M	Fawn	ET#20	Rocket net	Wood crate
12/19/84	Des Plaines	M	Fawn	ET#21	Rocket net	Wood crate
12/19/84	Des Plaines	F	Adult	RC#510	Rocket net	Wood crate
01/22/86	Busse	F	Fawn	RC#800[f]	Rocket net	Wood crate
01/22/86	Busse	M	Fawn	ET#32	Rocket net	Wood crate

cont.

Table 22: continued.

Date captured	Area of capture	Sex	Age at capture	Markings	Method of capture	Method of transport
03/27/86	Busse	F	Adult	RC#490 f	Drive net	Horse trailer
03/27/86	Busse	F	Fawn	RC#170	Drive net	Horse trailer
04/22/86	SE Cook Co.	F	Fawn	RC#630	Dart rifle	Van, then wood crate
01/28/87	Busse	M	Yearling	ET#33	Rocket net	Wood crate
01/28/87	Busse	M	Yearling	ET#34	Rocket net	Wood crate
01/28/87	Busse	F	Adult	RC#910	Rocket net	Wood crate
02/05/87	Busse	M	Yearling	ET#35	Rocket net	Wood crate
02/05/87	Busse	F	Fawn	RC#950	Rocket net	Wood crate
02/05/87	Busse	F	Fawn	RC#590	Rocket net	Wood crate
02/09/87	Des Plaines	F	Adult	RC#320	Rocket net	Horse trailer
02/09/87	Des Plaines	F	Fawn	RC#350	Rocket net	Horse trailer
02/09/87	Des Plaines	F	Fawn	RC#650	Rocket net	Horse trailer
02/09/87	Des Plaines	F	Yearling	RC#940	Rocket net	Horse trailer
02/09/87	Des Plaines	M	Adult	ET#36	Rocket net	Horse trailer
02/09/87	Des Plaines	M	Fawn	ET#37	Rocket net	Horse trailer
02/09/87	Des Plaines	M	Fawn	ET#38	Rocket net	Horse trailer
02/10/87	Des Plaines	M	Fawn	ET#39	Rocket net	Wood crate
02/18/87	Busse	M	Fawn	ET#41	Rocket net	Wood crate
02/18/87	Busse	F	Fawn	RC#670	Rocket net	Wood crate

cont.

Table 22: continued.

Date captured	Area of capture	Sex	Age at capture	Markings	Method of capture	Method of transport
02/23/87	Busse	F	Adult	RC#930	Rocket net	Wood crate
02/23/87	Busse	M	Fawn	ET#42	Rocket net	Wood crate
02/23/87	Busse	F	Fawn	RC#920	Rocket net	Wood crate

a Ned Brown Preserve (Busse Woods), CCFPD.
b Des Plaines Division, CCFPD.
c Number on white, plastic ear tag.
d Radio-collar identification number.
e Indicates first use of radio-collar.
f Indicates second use of radio-collar.

Table 23: Mean distances between successive locations and fates of 14 radio-collared white-tailed does, August 1986 - July 1987.

Deer #	Date released	Age at capture	# of locations	Mean distances (km)	Status, Aug.86-Jul.87
530	12/18/84	Adult	7	0.4	Remained in, or close to, Drummond Woods (JAAP).
550	12/18/84	Fawn	8	2.8	Exhibited annual trek; found in Hoff Wds.(JAAP) in Aug.86 Found 15 km ESE near town of Wilton Center in May-June 87
490	03/27/86	Adult	10	0.4	Remained within 1 km of release site.
170	03/27/86	Fawn	9	0.5	Remained in a small, private woodlot (unhunted) on north bank of Des Plaines R. just east of I-55.
910	01/28/87	Adult	8	0.8	Moved 3.2 km NW of release site within 2 months post-release & moved little thereafter.
320	02/09/87	Adult	6	1.0	Remained within 1 km of release site.
350	02/09/87	Fawn	4	3.0	By 03/04/87 had moved approx. 5 km WSW of release site. Returned within 1 km but lost collar prior to 06/12/87.
590	02/09/87	Fawn	7	0.7	Moved 3.2 km NW of release site within 4 days after release. Movements limited thereafter.
650	02/09/87	Fawn	1	2.6	Collar & carcass remains found on 03/04/87 about 2.6 km east of release site. Reportedly struck by car.
940	02/09/87	Yearling	1	0.5	Collar & carcass remains found $\leq$0.5 km of release site on 03/04/87. Cause of death not determined.

cont.

Table 23: continued.

Deer #	Date released	Age at capture	# of locations	Mean distances (km)	Status, Aug.86-Jul.87
950	02/09/87	Fawn	7	1.0	Stayed within 1.6 km of release site.
670	02/18/87	Fawn	5	0.7	Moved 3.2 km south to Hoff Wds. (JAAP) within 2 weeks & remained in this woodlot.
920	02/18/87	Fawn	6	2.7	Started moving west within 2 weeks and ended trek on Grant Creek Prairie Nature Preserve (Des Plaines Wildl. Cons. Area) by 03/23/87. Returned to within 1 km of release site by 06/12/87.
930	02/18/87	Adult	3	1.2	Found 5 km NNW of release site on 03/23/87. Remained in area of abandoned gravel pits, east of Des Plaines River, difficult to radio-locate.

Table 24: Number of mortalities by month of 19[a] radio-collared does transported to JATC since December 1984.

Age	Months since release				
	≤1	≤2	≤3 ...	≤10	≤11
Fawns	1	1	–	–	–
Yearlings	2	–	1	–	–
Adults	1	–	–	1	1

a Excludes 2 fawns that lost collars < 4 months post-release.

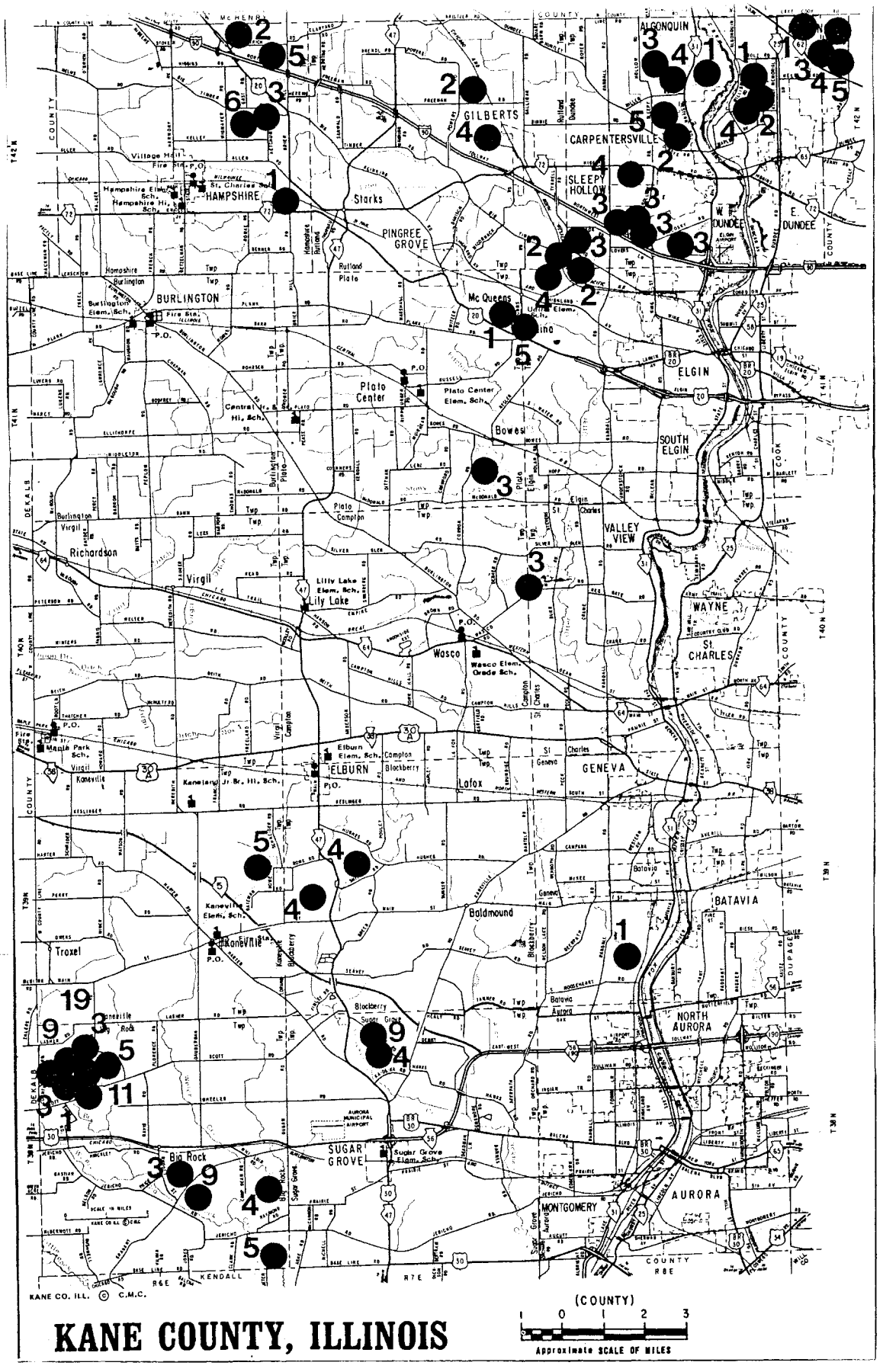
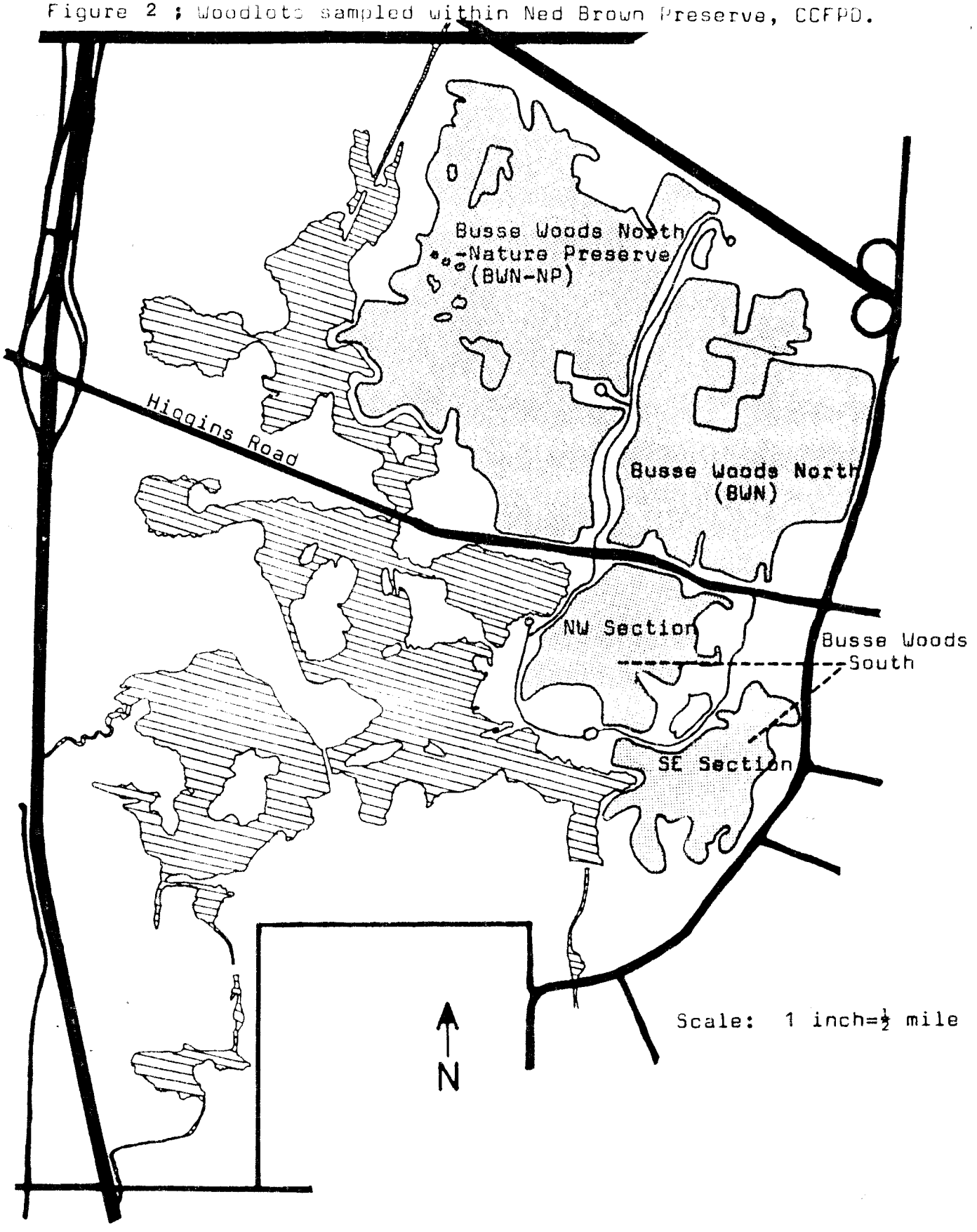


Fig. 1. Winter concentrations of deer in Kane County, January 1987. Dots represent locations of deer sightings. Number of deer per sighting is labeled.

Figure 2 ; Woodlots sampled within Ned Brown Preserve, CCFPD.



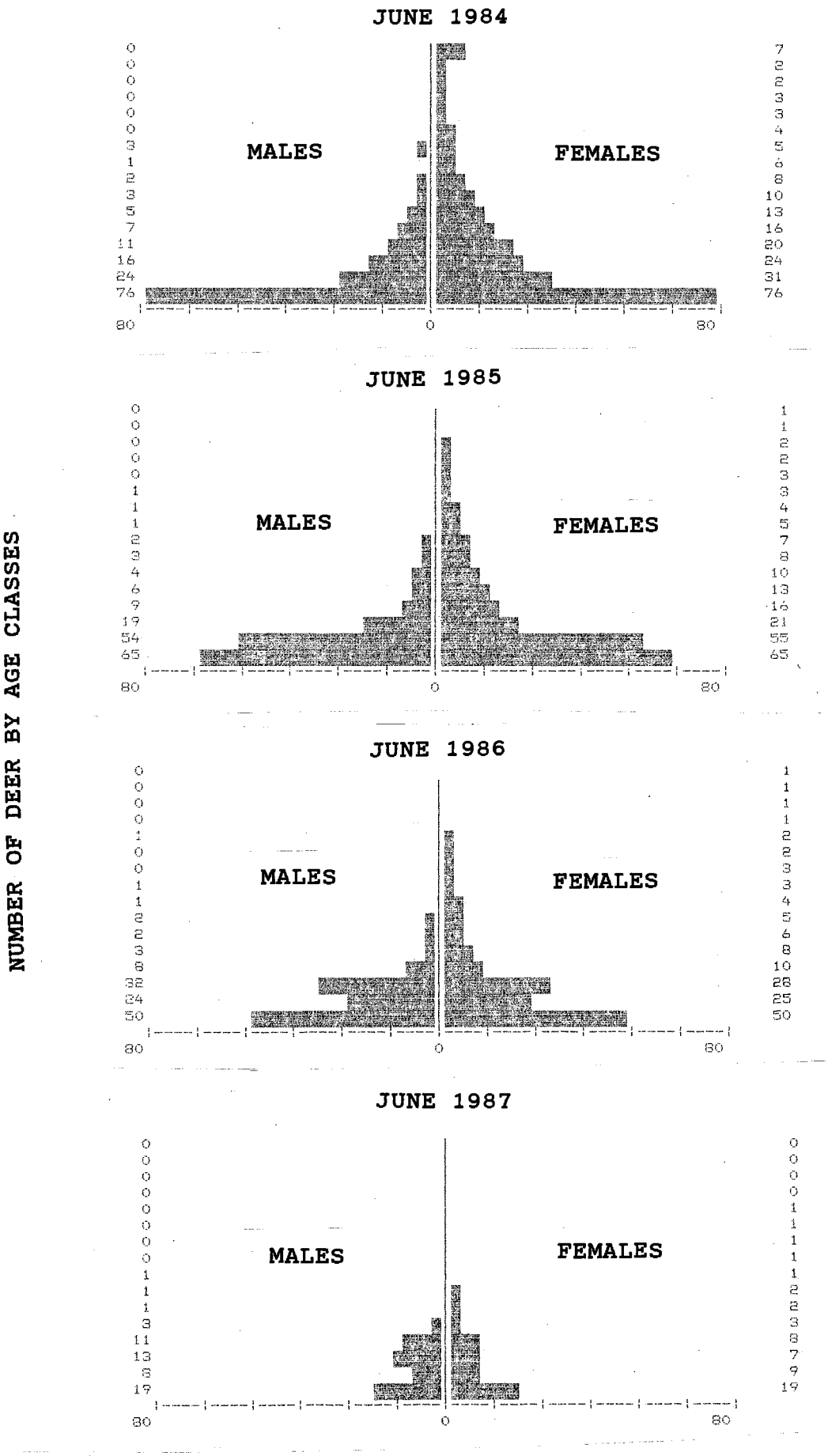


Fig. 3. Changes in sex and age structure of Ned Brown Preserve deer herd at start of Biological Years 1984, 1985, 1986, & 1987. Herd reduction occurred in 1986-87.

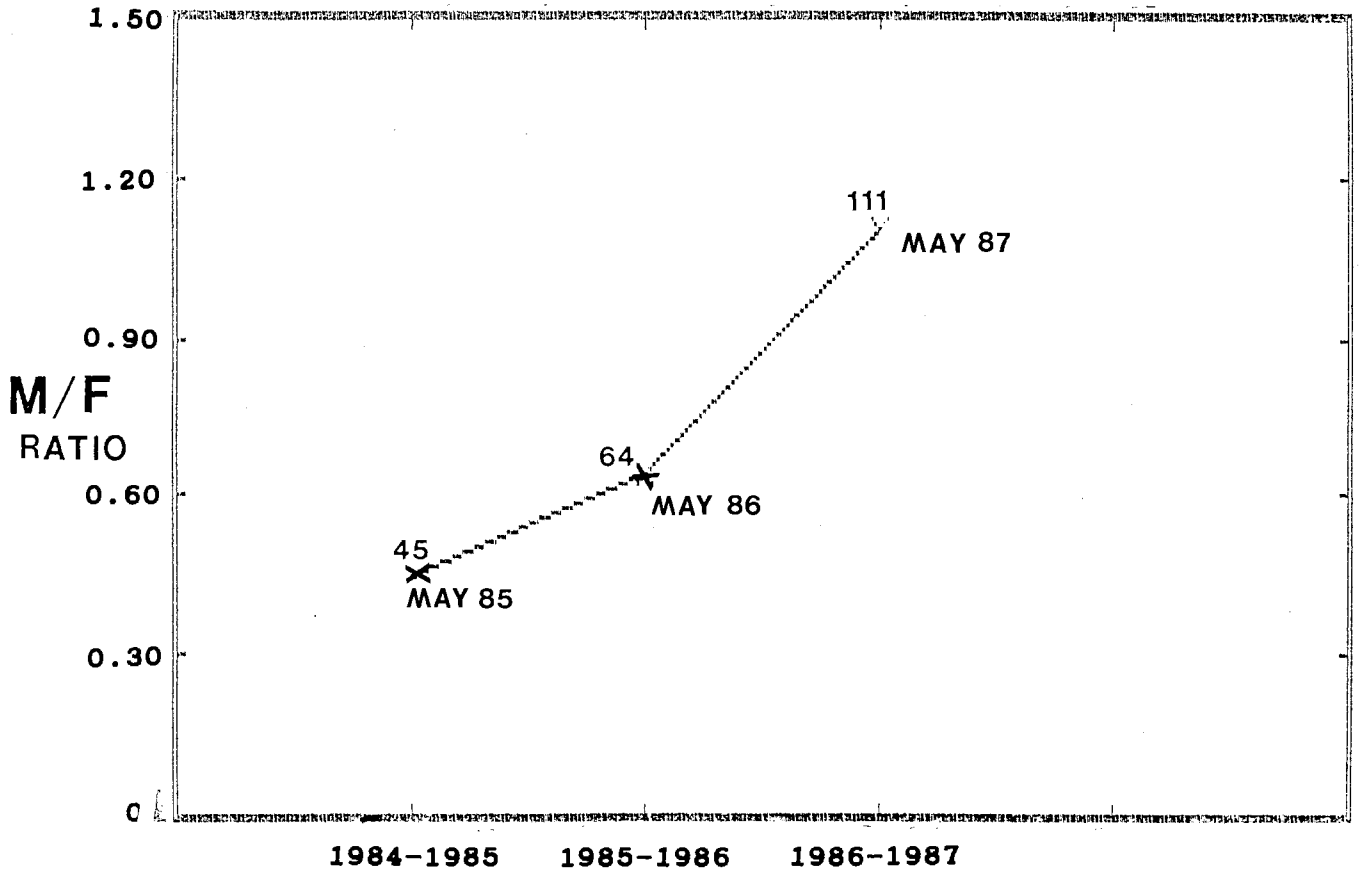


Fig. 4. Estimated number of deer in the Ned Brown Preserve at the start (June) and end (May) of Biological Years 1984-85, 1985-86, 1986-87

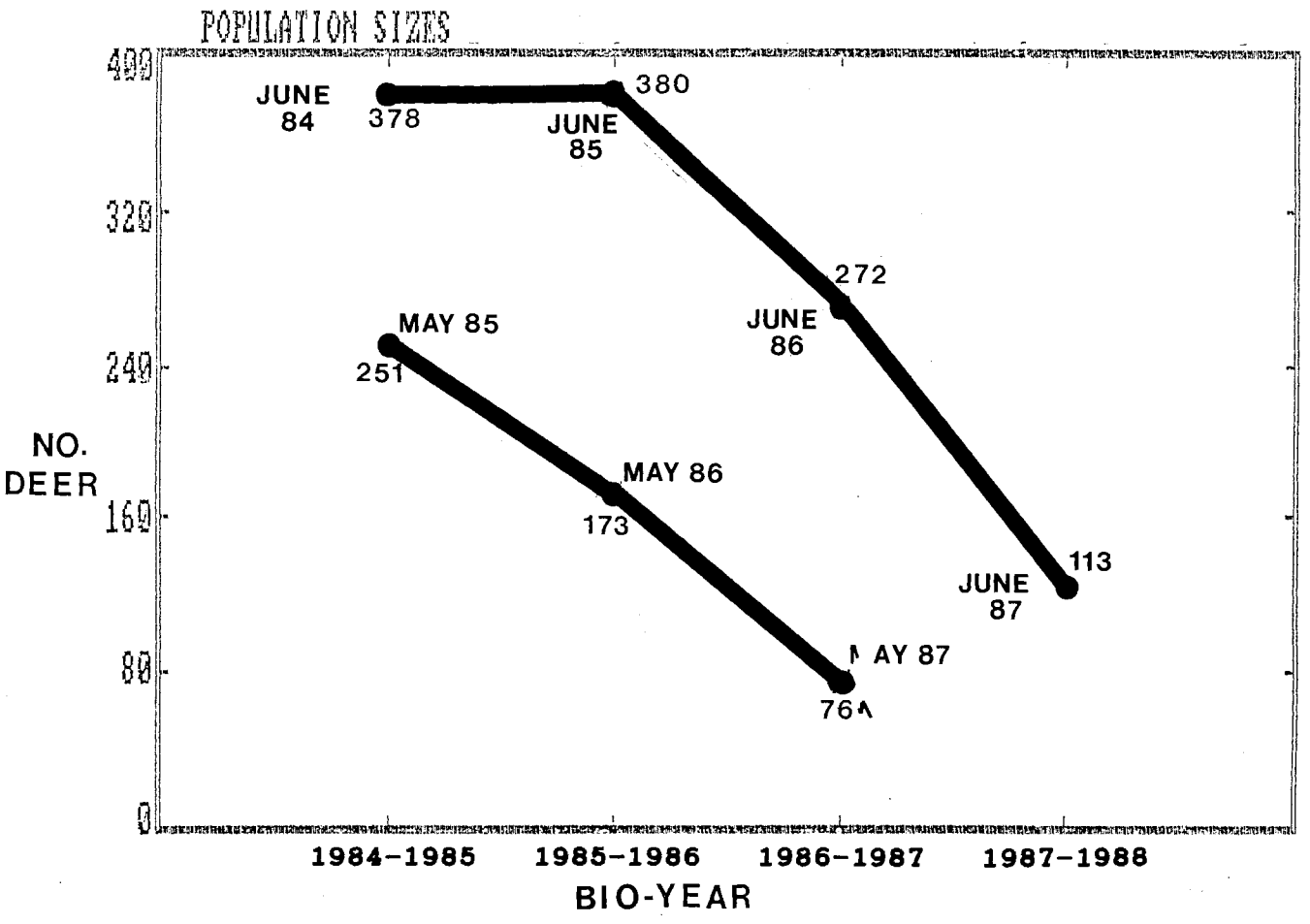
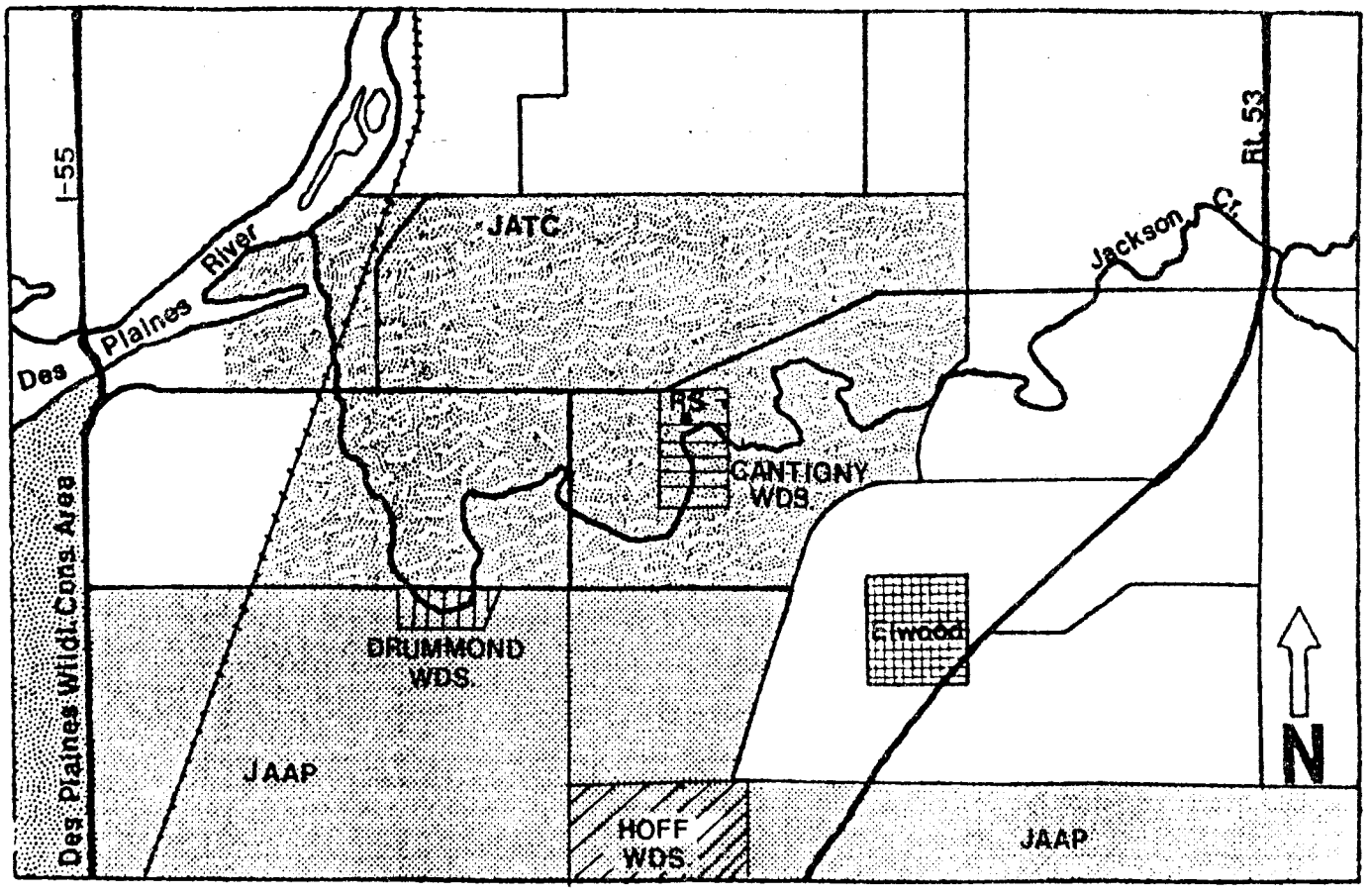


Fig. 5. Changes in end of Biological Year (May) male/female ratios for Ned Brown Preserve deer herd, 1984-85, 1985-86, and 1986-87 are a reflection of removal of deer during efforts at herd reduction.

Fig. 6 : Release site (RS) for 44 translocated white-tailed deer on the Joliet Army Training Center (JATC).



Scale: 1.6km = 1cm

JAAP = Joliet Army Ammunition Plant

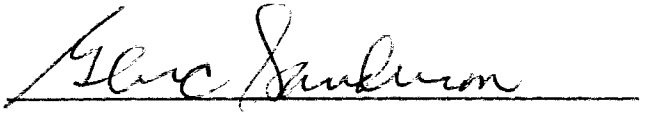
PREPARED BY:

James H. Witham
Assistant Professional Scientist
Illinois Natural History Survey

Jon M. Jones
Assistant Research Biologist
Illinois Natural History Survey

Date: 28 September 1987

APPROVED BY:



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

Appendix A. Helminthic and protozoan parasites of white-tailed deer in Urban areas of northeastern Illinois. Jose G. Cisneros.

Helminthic and Protozoan Parasites of White-tailed Deer in Urban Areas of Northeastern Illinois

Jose G. Cisneros

This report is part of the Urban Deer Study of the Illinois Natural History Survey. The project was a determination of the helminthic and protozoan parasites of white-tailed deer (Odocoileus virginianus) through fecal analysis. Animals sampled in this study are part of white-tailed deer herds found in urban locations of northeastern Illinois. Within the text is included detailed methodology, results of examinations, discussion of the significance of these results, and problems perceived in this study with recommendations for improvements.

METHODS

Over one thousand fecal samples were collected by Dr. James Witham during post mortem examinations of road-killed white-tailed deer during a twenty-three month period (December 1983 to October 22, 1985). Samples were frozen and stored for a period of one to three years. For parasitological examination, 270 samples were chosen from four sites: Northwest Cook County, Des Plaines, Busse Woods, and Non-Cook County. Within each location, samples were divided according to season collected - summer, fall, winter, and spring. All samples were from deer over one year of age.

Samples of feces were thawed for one hour before use and were processed for fecal flotation after Samuel and Trainer (1969). One gram of feces was placed into a beaker with 10ml of water. The pellets were broken up completely and the mixture was poured through standard cheesecloth into another beaker. Fecal material in the cloth was pressed with a lab spatula to remove all liquid. The liquid was then poured into a 15ml centrifuge tube and spun at 2200rpm for ten minutes in a clinical centrifuge. The supernatent was discarded and 6ml of Sheather's sugar solution (Levine et al., 1960) was added to the sediment and mixed with a spatula. Sugar solution was added to fill the tube, and the mixture was centrifuged for two minutes at 1100 rpm. After centrifugation, a positive meniscus was created on the tube by adding fresh sugar solution, and a 22mm square coverglass was placed over the top of the tube. After several minutes, the coverglass was removed and transferred to a glass slide. The entire surface of the coverglass was systematically examined for helminth eggs, larvae and coccidial oocysts with the aid of a compound microscope. Data for each sample were recorded on a standardized data sheet. Size was determined with an ocular micrometer. Relevant taxonomic keys and literature utilized in

identifying parasites included Kates and Shorb (1943), Becklund (1964), Samuel and Beaudoin (1965), Levine (1968) and Anderson and Samuel (1969).

RESULTS

Two hundred seventy fecal samples from four different areas in northeastern Illinois were examined. Examination revealed five species of nematodes and two species of coccidia. Seventy-four animals (28%) were found to carry one of more parasites which were represented by eggs, first stage larvae and oocysts (Table 1). Anatomical location of parasite in the host, number of deer infected, prevalence, intensity and size range is given for all parasites. Study wide, the trichostrongyloids showed the highest prevalence (11.5%) of all parasites found. (The designation "trichostrongyloids" in the tables includes eggs of the genera Haemonchus, Ostertagia, and Trichostrongylus, and is used due to the difficulties involved in distinguishing the eggs of these three genera. The genera are closely related and species identification based on eggs alone is not feasible. Eggs seen in this study could belong to one or more of the three genera.)

TABLE 1

Parasite prevalence and intensity of Illinois urban white-tailed deer as determined by fecal flotation.

Parasite	# Infected / # examined	Prevalence (%)	Intensity Range	Intensity Mean	Size (μ)
Trichostrongyloids	31/270	11.5	1-29	2.5	60-89x30-50
Oesophagostomum venulosum	5/270	2	1-4	2	70-100x36-55
Nematodirus odocoilei	6/270	2	1-9	3	140-190x53-80
Capillaria bovis	8/270	3	1-3	1.5	40-55x21-32
Parelaphostrongylus tenuis	16/270	6	1-14	3.5	190-350x10-17
Eimeria mccordocki	19/270	7	1-25	3	25-47x15-30
Eimeria madisonensis	3/270	1	1-2	1.5	17-22x17

Overall infection rate for study: 28%

Data for individual locations was separated to characterize the infections present in each. Light infections of three nematode species and one Eimeria species were found in Northwest Cook County (Table 2). Prevalence for Northwest Cook County is 25%.

Three nematode species and two species of coccidia were found in the Des Plaines area deer (Table 3). The Eimeria mccordocki infection rate is the highest for any area. Overall prevalence for the Des Plaines area is 24%.

Four species of nematodes and two species of Eimeria were discovered in Busse Woods samples (Table 4). The largest overall infection rates of this study were from the trichostrongyloid eggs (16%) and the P. tenuis larvae (14%) found in the Busse Woods samples. Prevalence for the Busse Woods collection is 41%.

Only three species of nematodes were found in the Non-Cook County samples, and low prevalences were determined for each (Table 5). The overall prevalence for Non-Cook samples is 11%.

Individual parasite prevalences for all four areas are compared in Table 6.

TABLE 2

Parasite prevalence and intensity for Northwest Cook County white-tailed deer.

Parasite	Prevalence (%)	Intensity	
		Range	Mean
Trichostrongyloids	8	1-2	1
Oesophagostomum venulosum	0	--	--
Nematodirus odocoilei	6	1-9	4.5
Capillaria bovis	2	1	1
Parelaphostrongylus tenuis	0	--	--
Eimeria mccordocki	10	1-5	2
Eimeria madisonensis	0	--	--

Animal sample size: 52 Infection rate: 25%
Animals found infected: 13

TABLE 3

Parasite prevalence and intensity for Des Plaines white-tailed deer.

Parasite	Prevalence (%)	Intensity	
		Range	Mean
Trichostrongyloids	10	1-4	2.5
Oesophagostomum venulosum	0	--	--
Nematodirus odocoilei	2	1	1
Capillaria bovis	0	--	--
Parelaphostrongylus tenuis	2	1	1
Eimeria mccordocki	12	1-25	6
Eimeria madisonensis	3.5	1-2	1.5

Animal sample size: 58 Infection rate: 24%
Animals found infected: 14

TABLE 4

Parasite prevalence and intensity for Busse Woods white-tailed deer.

Parasite	Prevalence (%)	Intensity	
		Range	Mean
Trichostrongyloids	16	1-29	3
Oesophagostomum venulosum	5	1-4	2
Nematodirus odocoilei	0	--	--
Capillaria bovis	5	1-3	1.5
Parelaphostrongylus tenuis	14	1-14	4
Eimeria mccordocki	6	1-2	1
Eimeria madisonensis	1	1	1

Animal sample size: 105 Infection rate: 41%
Animals found infected: 43

TABLE 5

Parasite prevalence and intensity for Non-Cook County white-tailed deer.

Parasite	Prevalence (%)	Intensity Range	Intensity Mean
Trichostrongyloids	7	1	1
Oesophagostomum venulosum	0	--	--
Nematodirus odocoilei	4	1-3	2
Capillaria bovis	4	2	2
Parelaphostrongylus tenuis	0	--	--
Eimeria mccordocki	0	--	--
Eimeria madisonensis	0	--	--

Animal sample size: 55 Infection rate: 11%
Animals found infected: 6

TABLE 6

Comparison of parasite prevalences in white-tailed deer from Northwest Cook County, Des Plaines Busse Woods and Non-Cook County areas.

	PREVALENCE			
PARASITE	NW Cook	Des Plaines	Busse Woods	Non-Cook
Nematoda:				
Trichostrongyloids	8	10	16	7
Oesophagostomum venulosum	0	0	5	0
Nematodirus odocoilei	6	2	0	4
Capillaria bovis	2	0	5	4
Parelaphostrongylus tenuis	0	2	14	0
Protozoa:				
Eimeria mccordocki	10	12	6	0
Eimeria madisonensis	0	3.5	1	0

Parasite intensities were generally low. Most eggs, larvae, and oocysts were present in numbers less than 10. The largest intensities seemed to correspond to the areas and particular parasite species with the highest prevalences: Des Plaines, E. mccordocki; Busse Woods, trichostrongyloids and P. tenuis.

Seasonal differences in parasite prevalence and intensity were examined between all sites and within each site. Winter samples showed the greatest percentage of infections (31%), but the infection rates of summer, spring and fall were only slightly lower (26%, 27% and 25%, respectively). Intensities were uniformly low except for relatively high Eimeria oocysts numbers in spring and fall and trichostrongyloid eggs and P. tenuis larvae in isolated animals during the summer.

Parasite assemblages also changed with seasons. The greatest number of multiple parasite infections within single deer occurred in the summer and winter seasons. Trichostrongyloid eggs were found most often in spring and summer, and Capillaria bovis eggs were found in the greatest number of animals in the fall. Oocysts of the coccidia Eimeria were found most often in winter samples. Parelaphostrongylus tenuis larvae were found in fecal samples collected at all times of the year (Table 7).

TABLE 7

Seasonal parasite prevalence (%) for Illinois urban White-tailed deer.

	PREVALENCE			
PARASITE	**Summer**	**Fall**	**Winter**	**Spring**
Nematoda:				
Trichostrongyloids	19	3	7	16
Oesophagostomum venulosum	0	0	3	3
Nematodirus odocoilei	5	5	0	0
Capillaria bovis	0	8	3	1
Parelaphostrongylus tenuis	5	6	7	5
Protozoa:				
Eimeria spp.	8	3	16	4

Within locations, Northwest Cook County and Non-Cook County showed the fewest infections during all seasons with relatively little winter and spring parasite activity (Tables 8 and 11). Des Plaines and especially Busse

Woods exhibited parasite infections year-round (Tables 9 and 10). Winter and spring infections at the latter two sites are most conspicuous by their numbers when compared to the Northwest Cook and Non-Cook samples.

TABLE 8

Seasonal parasite prevalence (%) for Northwest Cook County white-tailed deer.

	PREVALENCE			
PARASITE	**Summer**	**Fall**	**Winter**	**Spring**
Trichostrongyloids	20	0	0	0
Oesophagostomum venulosum	0	0	0	0
Nematodirus odocoilei	13	7	0	0
Capillaria bovis	0	7	0	0
Parelaphostrongylus tenuis	0	0	0	0
Protozoa:				
Eimeria spp.	13	0	43	0

TABLE 9

Seasonal parasite prevalence (%) for Des Plaines white-tailed deer.

	PREVALENCE			
PARASITE	**Summer**	**Fall**	**Winter**	**Spring**
Trichostrongyloids	8	0	13	20
Oesophagostomum venulosum	0	0	0	0
Nematodirus odocoilei	0	7	0	0
Capillaria bovis	0	0	0	0
Parelaphostrongylus tenuis	0	7	0	0
Protozoa:				
Eimeria spp.	8	13	20	13

TABLE 10

Seasonal parasite prevalence (%) for Busse Woods white-tailed deer.

	PREVALENCE			
PARASITE	**Summer**	**Fall**	**Winter**	**Spring**
Nematoda:				
Trichostrongyloids	29	11	11	23
Oesophagostomum venulosum	0	0	6	7
Nematodirus odocoilei	0	0	0	0
Capillaria bovis	0	11	6	3
Parelaphostrongylus tenuis	14	17	14	13
Protozoa:				
Eimeria spp.	10	0	14	3

TABLE 11

Seasonal parasite prevalence (%) for Non-Cook County white-tailed deer.

	PREVALENCE			
PARASITE	**Summer**	**Fall**	**Winter**	**Spring**
Nematoda:				
Trichostrongyloids	14	0	0	14
Oesophagostomum venulosum	7	0	0	0
Nematodirus odocoilei	7	6	0	0
Capillaria bovis	0	12.5	0	0
Parelaphostrongylus tenuis	0	0	0	0
Protozoa:				
Eimeria spp.	0	0	0	0

DISCUSSION

A single published report exists concerning abomasal and intestinal helminths of white-tailed deer in Illinois (Cook et al., 1979), and no published reports are available with respect to protozoa infections. The study by Cook et al. involved the necropsy of eighty-four deer and compared parasite infections in deer from northern and southern regions of the state. Cook's necropsies revealed the nematodes Gongylonema pulchrum, Apteragia odocoilei, Haemonchus contortus, Nematodirus sp., Trichuris sp., and Setaria yehi, and the cestode Moniezia benedeni in the northern sample (Carroll and Jo Daviess counties). Never published separately, Schaeffler and Levine (1968) reported data indicating an approximate 50% infection rate for P. tenuis in Illinois deer. The present study found two species of nematodes not previously reported for northern Illinois deer - Oesophagostomum venulosum and Capillaria bovis.

This study is the first report of protozoans in Illinois deer. Two species of coccidia - Eimeria mccordocki and Eimeria madisonensis, were found in the samples studied.

Although not previously reported in northern Illinois, O. venulosum, C. bovis, E. mccordocki and E. madisonensis, as well as the other parasite species found in this study, are all well known and common parasites of white-tailed deer in the United States. Davidson et al. (1981), the most recent compendium of disease and parasites of white-tails, lists prevalences of all these parasites in the various states where studies have been made. Particular studies which found similar assemblages include: Anderson and Samuel (1969) (samples from Pennsylvania, Texas and Wisconsin); Beaudoin, et al (1970) (samples from Pennsylvania); Samuel and Beaudoin (1965; 1966) (samples from Pennsylvania); Samuel and Trainer (1969) (samples from Wisconsin); and Prestwood et al (1973) (samples from southeastern United States, Texas and the Virgin Islands) and Cisneros (in prep.) (samples from Missouri). In most of the other studies, parasite prevalence was greater than that discovered in Illinois. Several explanations are possible. The most readily apparent is that Illinois deer are not as heavily parasitized as deer in other areas. Data from the northern study site of Cook et al. (1979), however, shows a significantly higher set of prevalence values with infection rates more similar to those found in other states than to those in the current study. This first explanation, therefore, is probably not valid.

A second possible reason for low parasite prevalence is the basic weakness of the fecal flotation procedure in indicating the full extent of an infection. Samuel and Trainer (1969) used fecal flotation to check Wisconsin deer for internal parasites and did identify eggs, larvae, and oocysts of many of the same species found in the present study.

However, their flotation findings were supplemented by necropsy recovery of parasites from deer in the study area. In most cases, necropsies revealed two to three times as many helminth infections as revealed by fecal flotation. In some cases, parasites not found in the flotation work were discovered during necropsy. Although the flotation method is the easiest and fastest way to assess the parasite assemblage within deer, necropsy of fresh kills is still the procedure of choice in order to receive the most accurate estimates of parasite prevalence and intensity. Most of the deer parasite studies previously cited were done by direct necropsy examination.

Finally, low prevalence and intensity figures of this study could have been influenced by prolonged freezing of the samples. The freezing and thawing processes can be very destructive to eggs and oocysts, and in fact, many trichostrongyloid eggs identified in this study were ruptured. Rupture most likely occurred as a result of a period of dessication prior to collection and post-collection freezing and thawing cycles before finally being examined. Ruptured eggs are often not recognizable as eggs and consequently are not counted. In fresh fecal samples, the presence of ten to twenty eggs normally does not indicate a heavy infection. However, due to potential loss of eggs, larvae and oocysts through the freezing process used in this study, infections represented by ten or more eggs, larvae or oocysts may actually indicate a heavy infection with lighter infections represented by only one or two eggs or oocysts. Those infections that are found may be perceived as lighter infections than they truly were, and some lighter or less resistant infections might be totally missed.

The last two factors described above may have contributed significantly to an apparent low parasite prevalence relative to the actual number of infected deer that may exist in the field.

Seasonal variation in parasite prevalence has been noted both between and within study sites. The comparison of overall seasonal prevalences: winter (31%), spring (27%), summer (26%) and fall (25%), indicates that the differences in overall infection rates are not statistically significant. The changing composition of parasite assemblages and the corresponding change in infection rates are noteworthy. Overall, trichostrongyloid prevalence is high in the spring and summer compared to fall and winter months (16%, 19% and 3%, 7% respectively). Eggs of the trichostrongyloid complex require warm temperatures and adequate moisture to develop - conditions most likely to occur during spring and summer. These nematodes continue to produce eggs during fall and winter, but in smaller numbers than when external conditions are favorable. The need for warm, moist conditions is reflected in the trichostrongyloid seasonal prevalence differences. During the winter, the prevalence of Eimeria spp. oocysts is also relatively high. Coccidia oocysts also

require heat and moisture to develop outside the deer, but oocysts are none-the -less released fairly continuously in the feces throughout the year. Eimeria spp. oocysts are very resistant to environmental extremes. The summer infection rate of 8% indicates a strong Eimeria presence. The winter rate of 16% shows an even greater presence which is probably related to changing habits of deer in this study. Deer typically have less food and more contact with other deer during winter due to the limited food resources. In the northern states, the deer habit of "yarding up" during the winter can lead to greatly increased contact between deer. Poor nutrition results in a reduced resistance to internal parasites. Coccidia multiply within an animal, and the parasite is spread to other deer feeding in the same area as the infected animal.

The expanded parasite assemblages found in the summer are attributable to the ideal summer growth situations for many parasite species. During winter months, the increased chance of cross transmission and the relatively debilitated state of health of deer result in expanded parasite assemblages.

In terms of each location, Eimeria spp. winter infection rate in Northwest Cook is high (43%) in spite of a small sample size. However, the samples did not indicate a high parasite intensity. The high infection rate may be due to the poor nutritional and overcrowded situation described above. The remainder of the protozoan infection record for Northwest Cook is unremarkable.

Busse Woods shows a year-round parasite presence of all but one of seven parasite species found, indicating a healthy parasite population supported by the conditions of the deer host environment.

Des Plaines and Non-Cook county areas are unremarkable in their seasonal parasite prevalences.

Based on the findings of this study, Northwest Cook county and Non-Cook county areas have the smallest parasite assemblages and the lowest parasite prevalences within their populations. Des Plaines and Busse Woods have significantly larger assemblages and prevalences. Northwest Cook and Non-Cook deer populations are described as low density and high quality with a high nutritional plane. These descriptions are in line with the results of this parasitological study. Low density and good nutrition lead to healthy deer which encounter each other only rarely . These factors are all barriers against parasite transmission and large parasite intensities. High density and poor population quality lead to populations more susceptible to cross-transmission and harboring larger numbers of parasites. Such a situation is seen in Des Plaines and Busse Woods deer.

PARASITE LIFE CYCLES AND ASSOCIATED PATHOGENICITY

Knowledge of each specific parasite's life-cycle will help to explain the influence of seasons and herd density on the occurrences of the parasite.

Ostertagia odocoilei, O. mossi, Haemonchus contortus, and Nematodirus odocoilei are all trichostrongyloids of the abomasum and share a common life cycle. Eggs are deposited in the feces and given the neccessary conditions (i.e. oxygen, moisture and warm temperatures), the eggs hatch within one to two days and the first stage larvae emerge. Still within the feces, the rhabiditiform larvae undergo two molts within the span of a few days. The infective third stage larvae then climbs onto browse where it is ingested by feeding deer. Larvae grow to adults within the gastrointestinal tract.

Pathology associated with trichostrongyloids is blood loss leading to weakness, emaciation and anemia (Davidson et al., 1981; Olsen, 1962). Van Volkenberg and Nicholson (1943) found that deer without adequate browse and under seasonally poor nutritional conditions were susceptible to starvation often accompanied by heavy parasitism, especially by trichostrongyles. Although trichostrongyles contributed to the deaths of a few deer in their study, they claimed that parasite infections were apparently unimportant among deer on ranges with sufficient food.

O. odocoilei, O. mossi and N. odocoilei are all species specific to white-tailed deer. There have been no reports of these parasites in domestic ruminants. There is no threat to humans from any of the parasites due to the very specific biology and ecology of these parasites which restricts them to inhabiting white-tailed deer.

Haemonchus contortus has been reported in cattle (Bos taurus) and sheep (Ovis aries) as well as deer. Some evidence points to the feasibility of cross-transmission between these three hosts. Successful laboratory infections have been produced with sheep being infected with deer H. contortus and vice versa (Samuel, 1968). Prestwood and Pursglove (in Davidson et al., 1981) indicate that although cross-infection has been proven possible in the laboratory and sheep, cattle and deer do all carry H. contortus, much data is still needed to determine whether the parasite infections are exchanged in nature and whether they are a pathogenic threat in all species concerned.

Capillaria bovis, a parasite of the small intestine, is part of the Trichurata and little is known about its life cycle. This species is widely distributed throughout the U. S. and infects cattle as well as deer. Its pathogenicity is unknown. Low infection intensities and low prevalences found in this and other studies (Samuel and Trainer, 1969) would seem to

indicate that this species is unimportantant pathologically to white-tailed deer. Low prevalences in deer would indicate a poor potential as parasite reservoirs for domestic ruminants such as cattle. There is no threat to humans from this parasite.

Oesophagostomum venulosum is a strongyle parasite of the colon. Infective third stage larvae develop on the ground five to six days after exposure to optimum conditions of temperature and moisture (Levine, 1968). After ingestion, larvae enter the wall of the intestine and molt to the fourth stage. Seventeen to twenty-two days after infection, these larvae molt to the adult stage. No pathogenic effects have been reported for white-tailed deer. O. venulosum has been reported from a number of wild and domestic ruminants worldwide. In the U.S. this parasite has been reported in cattle, sheep, and goats (Capra hircus) (Shorb, 1939; Whitlock, 1939; Levine, 1963) where it can damage the intestinal wall. The low parasite prevalence and intensity found in this study and in others probably makes white-tailed deer populations poor infection reservoirs from which to infect other ruminants. There is no threat to humans from this parasite.

Parelaphostrongylus tenuis , the meningeal worm which inhabits the brain and spinal cord, has been of some importance in the last twenty years due mostly to its destructive effect on non-natural hosts, in particular moose (Alces alces), reindeer (Rangifer tarandus) and elk (Cervus canadensis) (Anderson, 1965; 1970; Carpenter et al., 1973; Karns, 1967; Prestwood and Smith, 1969). P. tenuis infections are acquired by ingestion of gastropod intermediate hosts containing infective third stage larvae. Eggs develop in the heart and lungs into first stage larvae which are swallowed and passed in feces. First stage larvae penetrate the foot of terrestrial snails where they grow and undergo two molts. The infective third stage larvae is acquired by deer when infected snails are accidentally ingested with browse. Third stage larvae migrate into the nervous system and develop into adult forms finally migrating into the cranium. As a natural host, the pathogenic effect of P. tenuis on the white-tailed deer appears minimal. The prevalence of this parasite can be anywhere between 5% and 86% nationwide. In experimental conditions, heavy infections are accompanied by depression, weakness, ataxia, and posterior paralysis (Davidson et al., 1981). Massive infections, with visible signs, are considered extremely rare under field conditions. P. tenuis infections have been found naturally and have been experimentally established in sheep,and goats (Anderson and Strelive, 1972; Nielson and Aftosmis, 1964). The real threat of this parasite is to other native American ungulates including moose, elk, and caribou and exotics such as fallow deer (Dama dama). Severe neurologic disorder resulting from P. tenuis infiltration of the brain has been documented in all these species. There is no threat to humans from this parasite.

Protozoan infections by Eimeria mccordocki and E. madisonensis are acquired by ingestion of sporulated oocysts. Unsporulated oocysts are passed in feces and exposure to oxygen and moisture outside the host leads to sporulation. Heavy infections are marked by diarrhea, sometimes leading to emaciation, apathy, passage of blood and ultimately death (Davidson, et al., 1981). Evidence suggests infection intensity declines with the deer's age due to acquired resistance resulting from previous infections. As previously discussed, crowded conditions and poor nutrition contribute to Eimeria infections. Anderson and Samuel (1969) report that both E. mccordocki and E. madisonensis are found only in white-tailed deer . These parasite are therefore very species specific and there is little chance of transmission to domestic ruminants and no threat to humans.

SUMMARY AND CONCLUSIONS

The low prevalences and low intensities indicate that none of the deer in this study were heavily parasitized, nor do they show a threat to the general deer population in terms of parasitic infection. In the most general terms, the results of this study can be seen as an indicator that deer of the four study areas, Northwest Cook County, Des Plaines, Busse Woods, and Non-Cook County, are relatively healthy. The deer of Des Plaines and Busse Woods may not be as healthy as those of Northwest Cook and Non-Cook, but this phenomenon may be attributable to the differences in density and nutritional quality of their respective areas. Studies such as those by the Southeast Cooperative Wildlife Disease Study (Eve and Kellogg, 1977) and Demarais, et al. (1983) are attempting to construct deer herd health indices which utilize intensity of parasite infections to show a positive correlation to deer density. The aim is to create an index of correlations so that by checking a relatively small sample of the herd on a regular basis and comparing the parasite count to the established index it is possible to determine the density and health of the herd. This study in no way approaches that level of sophistication, but it does serve to inform the investigator of parasites present in the deer and lend support to any previously suspected trends in the population.

FINAL COMMENTS ON THE EFFECTIVENESS OF THIS STUDY

All samples were processed as one gram of feces so that intensity is measured as number of parasite eggs per one gram of feces. The term "intensity" is relatively useless in terms of parasite eggs and fecal flotations as a whole since adult parasites are capable of producing many eggs. Eggs counted from one animal for a single species of parasite may have been created by one or by a dozen nematodes. There are no rules concerning numbers of males and females; only dissection and extraction can determine exact parasite population numbers. Fecal flotation is useful as a tool to establish parasite assemblages , but not intensities. The exception is when the number of eggs, larvae or oocysts is so large that a heavy infection can be deduced. Such was not the case in this study. There were no indications of heavy or massive infections in any of the samples examined. Samples which did contain parasites contained too few specimens to allow estimation of the number of adult parasites involved.

More infections might have been detected and the accuracy of this study increased if the samples had been stored in 10% formalin rather than frozen for one to three years. Experience shows the condition of parasite eggs and oocysts is significantly better after storage in formalin than after freezing.

ACKNOWLEDGEMENTS:

I would like to thank Dr. J. Witham for the opportunity to work on this Urban Deer Study project. I am also very grateful to Dr. Glen Sanderson, Dr. Sue Wood and Dr. Anderson for their help in providing laboratory space and equipment. Finally, I would like to thank my wife, Lee Anne, for her patience and valuable typing skills, and Dr. Leslie Uhazy for reviewing the manuscript.

Literature Cited

Anderson, R. C. 1965. An examination of wild moose exhibiting neurologic signs in Ontario. Can. J. Zool. 43: 635-639.

Anderson, R. C. 1970. Neurologic disease in reindeer (Rangifer tarandus tarandus) introduced into Ontario. Can. J. Zool. 49: 159-166.

Anderson, D. R. and W. M. Samuel. 1969. Eimeria (Protozoa: Eimeridae) from white-tailed deer (Odocoileus virginianus) in Pennsylvania, Texas, and Wisconsin, with descriptions of two new species. Bull. Wildlife Dis. Assoc. 5: 351-356.

Anderson, R. C. and U. R. Strelive. 1972. Experimental cerebrospinal nematodiasis in kids. J. Parasitol. 58: 816.

Becklund, W. W. 1964. Revised checklist of internal and external parasites of domestic animals in the U. S. and possessions and Canada. Am. J. Vet. Res. 25: 1380-1416.

Carpenter. J. W., H. E. Jordon, and B. C. Ward. 1973. Neurologic diseas in wapiti naturally infected with meningeal worms. J. Wildlife Dis. 9: 148-155.

Cook, T. W., B. T. Ridgeway, R. Andrews, J. Hodge. 1979. Gastrointestinal helminths in white-tailed deer (Odocoileus virginianus) of Illinois. J. Wildlife Dis. 15: 405-407.

Davidson, W. R. , F. A. Hayes, V. F. Nettles, F. E. Kellogg, eds. 1981. Diseases and parasites of white-tailed deer. Tall Timbers, Tallahassee, Fl., 458 pp.

Demarais, S., H. A. Jacobson, and D. C. Guynn. 1983. Abomasal parasites as a health index for white-tailed deer in Mississippi. J. Wildlife Mgmt. 47: 247-252.

Eve, J. H. and F. E. Kellogg. 1977. Management implications of abomasal parasites in southern white-tailed deer. J. Wildlife Mgmt. 41; 169-177.

Karns, P. D. 1967. Pneumostrongylus tenuis in deer in Minnesota and implications for moose. J. Wildlife Mgmt. 31: 299-303.

Levine, N. D. 1963. Weather, climate and the bionomics of ruminant nematode larvae. Adv. in Vet. Sci. 8: 215-261.

Levine, N. D. 1968. Nematode parasites of domestic animals and of man. Burgess, Minneapolis, Mn. 600 pp.

Levine, N. D., K. N. Mehra, D. T. Clark, and I. J. Aves. 1960. A comparison of nematode egg counting techniques for cattle and sheep feces. Am. J. Vet. Res. 21: 511-515.

Kates, K. C. and D. A. Shorb. 1943. Identification of eggs of nematodes parasitic on domestic sheep. Am. J. Vet. Res. 4: 54-60.

Nielson, S. W. and J. Aftosmis. 1964. Spinal nematodiasis in two sheep. J. Am. Vet. Med. Assoc. 144: 155-158.

Olsen, O. W. 1962. Animal parasites: their biology and life cycles. Burgess, Minneapolis, Mn. 346 pp.

Prestwood, A. K. and S. R. Pursglove. 1975. Helminth parasitisms among intermingling insular populations of white-tailed deer, feral cattle, and feral swine. J. Am. Vet. Med. Assoc. 166: 787-789.

Prestwood, A. K. and J. F. Smith. 1969. Distribution of meningeal worm (Pneumostrongylus tenuis) in deer in the southeastern United States. J. Parasitol. 55: 720-725.

Prestwood. A. K., F. A. Hayes, J. H. Eve, and J. F. Smith. 1973. Abomasal helminths of white-tailed deer in southeastern United States, Texas and the Virgin Islands. J. Am. Vet. Med. Assoc. 163: 556-561.

Samuel, W. M. 1968. Endoparasites of domestic ruminants and white-tailed deer. Tr. North Am. Wildlife Conf. 33: 364-372.

Samuel, W. M. and R. L. Beaudoin. 1965. Identification of eggs and larvae of nematodes parasitic in deer in Pennsylvania. Proc. Penn. Acad. Sci. 39: 73-77.

Samuel, W. M. and R. L. Beaudoin. 1966. Evaluation of two survey methods for detection of helminth infections in white-tailed deer (Odocoileus virginianus). Bull. Wildlife Dis. Assoc. 2: 100-107.

Samuel, W. M. and D. O. Trainer. 1969. A technique for survey of some helminth and protozoan infections of white-tailed deer. J. Wildlife Mgmt. 33: 888-894.

Schaeffler, W. and N. Levine (unpub. data, p. 287). 1968. In: Nematode parasites of domestic animals and of man. Edited by N. D. Levine. Burgess, Minneapolis, MN. 600 pp.

Shorb, D. A. 1939. Differentation of eggs of various genera of nematodes parasitic in domestic ruminants in the U. S. U. S. Dept. of Agr. Tech. Bull. 694: 1-10.

Van Volkenburg, H. L. and A. J. Nicholson. 1943. Parasitism and malnutrition of deer in Texas. J. Wildlife Mgmt. 7: 220-223.

Whitlock, S. C. 1939. The prevalence of disease and parasites of white-tailed deer. Tr. 4th North Am. Wildlife Conf. pp. 244-249.

Appendix 1
Infection Data by Specimen
Northwest Cook County

T = Trichostrongyloid
N = Nematodirus
O = Oespohagostomum
C = Capillaria
P = Parelaphostrongylus
E = Eimeria

Data #	UDS #	Season	Confirmed Infection	General Infection Information
1	44	W	x	E (micropyle) 28-30 x 15-20μ, 5 found
2	510	W	x	E (micropyle) 35 x 25 , 1 found
3	43	W		
4	59	W		
5	71	W		
6	520	W		
7	991	F		
8	473	F		
9	912	F		
10	537	W	x	Coccidia egg, 35 x 15μ, 1 found
11	998	F		
12	963	F		
13	979	F	x	N egg, 155-170 x 75μ 9 found
14	983	F	x	Dark bioperculate eggs, 40 x 25μ, 1 found (possible C)
15	454	F		
16	474	F		
17	855	S		
18	428	F		
19	417	F		
20	439	F		
21	003	F		
22	006	F		
23	329	F	x	T egg (ruptured) 80 x 45μ, 1 found
24	866	S		
25	846	S	x	Large, dark coccidian (micropyle present) 50 x 30 μ, 1 found (sheep?); T egg, 75 x 50μ, 1 found; N egg, 165 x 75μ, 1 found
26	256	S		
27	252	S		
28	844	S	x	E 38 x 25 , 1 found; egg-like structure, 35 x 20 μ, 6 - 8 found; N egg (deflated) 160 x 75μ, 2 found; N egg (whole), 155 x 80μ, 1 found
29	814	S		
30	842	S		
31	813	S		
32	856	S	x	T egg (deflated), 80 x 45-50μ, 2 found
33	165	Sp		
34	109	Sp		
35	157	Sp		
36	812	S		
37	816	S	x	T egg, 70 x 40μ, 1 found

38	838	S		
39	135	Sp		
40	835	S		
41	125	Sp		
42	712	Sp		
43	130	Sp		
44	728	Sp		
45	193	Sp		
46	754	Sp		
47	164	Sp		
48	810	S	x	E. (micropyle) 28-30 x 20-22$_{4}$, 2 found
49	100	Sp		
50	103	Sp		
51	677	Sp		
52	105	Sp		

Appendix 2
Infection by specimen
Des Plaines

T = Trichostrongyloid
N = Nematodirus
O = Oespohagostomum
C = Capillaria
P = Parelaphostrongylus
E = Eimeria

Data #	UDS #	Season	Confirmed infection	General infection information
53	903	S	x	E, 22 x 17μ, 1 found
54	906	S		
55	890	S		
56	894	S		
57	806	S	x	T, yellow/silver color, ruptured, 75-90 x 30-35μ , 3 found
58	986	F		
59	830	S		
60	911	F	x	E, silver, rough, micropyle, 35-47 x 25 -30μ, 15 found
61	280	S		
62	249	S		
63	824	S		
64	825	S		
65	276	S		
66	289	S		
67	422	F	x	N, ruptured, 190 x 75μ, 1 found
68	443	F	x	P, kinked tail, 225 x 10-15μ, 1 found
69	442	F		
70	448	F		
71	404	F	x	E, micropyle with yellow interior, 35 x 25μ, 1 found
72	392	F		
73	873	S		
74	917	F		
75	455	F		
76	478	F		
77	415	F		
78	689	Sp		
79	185	Sp		
80	649	Sp		
81	353	F		
82	688	Sp		
83	344	F		
84	369	F		
85	213	Sp	x	E, 30-35 x 22-25μ, 25 found
86	679	Sp		
87	181	Sp		
88	676	Sp	x	E, micropyle, 35 x 27μ, 2 found; E, round, 17 x 17μ, 2 found; T, 75-80 x 35-45μ, 4 found
89	172	Sp	x	T, 1 found
90	182	Sp		
91	174	Sp		
92	175	Sp		
93	153	Sp		
94	572	W		
95	041	W		
96	083	W		
97	601	W		
98	666	Sp		

99	542	W	x	T, 3 found
100	496	W	x	T, ruptured, 75 x 35$_{\mu}$, 2 found
101	568	W		
102	552	W		
103	569	W		
104	544	W	x	E, micropyle, 25 x 20$_{\mu}$, 1 found
105	062	W		
106	584	W		
107	585	W		
108	583	W	x	E, 30 x 20-30$_{\mu}$, 2 found
109	149	Sp	x	E, 25 x 20$_{\mu}$, 1 found; T, ruptured, 70 x 30$_{\mu}$, 1 found
110	549	W		

Appendix 3
Infection by Specimen
Busse Woods

T = Trichostrongyloid
N = Nematodirus
O = Oespohagostomum
C = Capillaria
P = Parelaphostrongylus
E = Eimeria

Data #	UDS #	Season	Confirmed infection	General infection information
111	840	S		
112	310	S		
113	239	S	x	T, 82 x 35μ, 1 found; T 65-70 x 40μ, 1 found
114	836	S	x	P, kinked tail, 225-240 x 10μ, 14 found; T, silver gray, 80-85 x 40-45μ, 2 found
115	274	S	x	E, round, 17 x 17μ, 1 found
116	299	S		
117	826	S	x	E, 25 x 20μ, 1 found; T, 70 x 37μ, 1 found
118	892	S		
119	260	S		
120	275	S		
121	886	S		
122	895	S	x	T, ruptured, 80 x 50μ, 2 found
123	802	S		
124	815	S		
125	871	S		
126	888	S		
127	322	S	x	T, 75 x 35-40μ, 1 found
128	2072	W		
129	829	S	x	P, 255 x 10μ, 3 found
130	854	S		
131	2063	W	x	T, ruptured, 60 x 35μ, 1 found; E, micropyle, 30-35 x 25μ, 2 found
132	2064	W		
133	831	S		
134	905	S	x	T, ruptured, 75-85 x 35-42μ, 29 found; T larvae, 6 found; P, kinked tail, 190-225 x 10-15μ, 6 found
135	2049	W		
136	2056	W		
137	557	W	x	T, 80-85 x 40-45μ, 2 found
138	2033	W	x	E, micropyle, 25-27 x 15μ, 1 found
139	2070	W	x	P, 225-250 x 10μ, 7 found; P, (better condition) 350 x 17μ, 1 found; E, 25 x 20μ, 1 found
140	2073	W		
141	030	W		
142	036	W		
143	528	W		
144	602	W		
145	024	W		
146	2020	W	x	O, 70 x 55μ, 1 found; T, 70 x 35μ, 1 found; P, 1 found
147	2027	W		
148	2028	W		
149	2038	W	x	P, 235-250 x 10-15μ, 3 found
150	2059	W		
151	2055	W	x	C, 50-55 x 22-25μ, 3 found
152	2075	W	x	E, 25 x 15μ, 1 found
153	2022	W		
154	2037	W	x	C, 55 x 27μ, 1 found; O, 85-90 x 40μ, 2 found

155	042	W		
156	046	W	x	T, ruptured, 75-85 x 40-42$_{M}$, 2 found
157	2046	W	x	E, 25 x 17$_{M}$, 1 found; T, 70 x 35$_{M}$, 1 found
158	2050	W	x	P, 200-210 x 10-12$_{M}$, 2 found
159	038	W		
160	078	W		
161	031	W		
162	051	W		
163	023	W		
164	025	W	x	P, 250-300 x 15$_{M}$, 1 found
165	067	W		
166	082	W		
167	2048	W		
168	2117	Sp	x	T, ruptured, 80 x 37$_{M}$, 1 found
169	2081	Sp		
170	2086	Sp	x	T, 75 x 32$_{M}$, 1 found
171	627	Sp	x	T, ruptured, 75-80 x 32-40$_{M}$, 2 found
172	638	Sp		
173	620	Sp		
174	660	Sp	x	T, ruptured, 60 x 35$_{M}$, 1 found
175	2095	Sp	x	P, 225 x 15$_{M}$, 2 found
176	2114	Sp	x	P, 235-240 x 12-15$_{M}$, 2 found
177	2099	Sp		
178	2105	Sp		
179	644	Sp		
180	2125	Sp		
181	2120	Sp	x	P, 220 x 10$_{M}$, 2 found
182	2123	Sp	x	P, 205-220 x 10$_{M}$, 5 found
183	694	Sp	x	T, 75-85 x 35-45$_{M}$, 2 found
184	797	Sp		
185	225	Sp	x	T, 85 x 30$_{M}$, 2 found
186	748	Sp		
187	098	Sp	x	O, 90-100 x 47-55$_{M}$, 4 found
188	191	Sp		
189	115	Sp	x	O, 98 x 46$_{M}$, 2 found
190	150	Sp	x	C, 51 x 25$_{M}$, 1 found
191	187	Sp		
192	695	Sp		
193	2005	F	x	T, 70-76 x 37$_{M}$, 2 found
194	970	F		
195	331	F	x	T, 87 x 42$_{M}$, 1 found
196	378	F		
197	949	F		
198	801	Sp		
199	2006	F	x	C, 53 x 25$_{M}$, 1 found
200	2008	F		
201	177	Sp		
202	188	Sp		
203	171	Sp		
204	176	Sp	x	T, 77-79 x 35$_{M}$, 2 found; E, 30 x 23$_{M}$, 1 found
205	470	F	x	P, 253 x 12$_{M}$, 1 found
206	475	F		
207	346	F		
208	2010	F		
209	004	F		
210	2013	F	x	P, 270-276 x 10-13$_{M}$, 3 found
211	336	F		
212	2011	F		
213	351	F	x	C, 51 x 25$_{M}$, 1 found
214	357	F	x	P, 253-287 x 16$_{M}$, 3 found
215	2014	F		

Appendix 4
Infection by Specimen
Non-Cook

T = Trichostrongyloid
N = Nematodirus
O = Oespohagostomum
C = Capillaria
P = Parelaphostrongylus
E = Eimeria

Data #	UDS #	Season	Confirmed infection	General infection information
216	975	F		
217	976	F		
218	400	F		
219	877	S		
220	907			
221	960	F		
222	430	F		
223	449	F		
224	416	F		
225	431	F	x	C, 40-46 x 21-23μ, 2 found
226	460	F	x	N, 150-160 x 70-75μ, 3 found
227	956	F		
228	350	F		
229	425	F		
230	374	F		
231	396	F		
232	526	W		
233	553	W		
234	001	W		
235	2024	W		
236	387	F		
237	536	W		
238	002	W		
239	081	W		
240	504	W		
241	507	W		
242	514	W		
243	541	W		
244	765	Sp		
245	796	Sp		
246	080	W		
247	673	Sp		
248	713	Sp	x	T, 72 x 40μ, 1 found
249	757	Sp	x	T, 75 x 35μ, 1 found
250	202	Sp		
251	742	Sp		
252	818	S		
253	878	S		
254	635	Sp		
255	647	Sp		
256	811	S		
257	819	S	x	T, 72 x 30μ, 1 found; N, 140 x 53μ, 1 found
258	827	S		
259	875	S		
260	847	S		
261	870	S		
262	114	Sp		

263	247	S		
264	321	S		
265	843	S		
266	085	Sp		
267	820	S	x	T, 86 x37$_{4}$, 1 found
268	119	Sp		
269	158	Sp		
270	251	S		

Addendum

The original sample inventory submitted for flotation included 274 fecal groups. The final number examined was 270. From the original list, six samples were exempted per your request. Three samples, 963 (Northwest Cook), 78 and 826 (Busse Woods) were found in the sample bags and were analyzed in place of three samples, 969 (Northwest Cook), 73 and 876 (Busse Woods) listed on the inventory, but not found in the bags. Two additional samples (877 and 907, Non-Cook) found in the bags but not listed in the inventory were analyzed.

Appendix B. Recommendations for a cooperative new initiative on urban deer management for Cook County, Illinois.

EXECUTIVE SUMMARY:

TITLE: Cooperative Urban Deer Management in Cook County, Illinois

In this report, we focus on the need to address deer-human conflicts in Cook County, Illinois. Specifically, we provide information that can be used by principal wildlife (Illinois Department of Conservation) and land resource (Cook County Forest Preserve District) agencies, to develop a cooperatively supported new initiative on urban deer management in Cook County, where deer-related damage has exceeded threshold levels of social and ecological tolerance.

PROBLEM

In suburban Cook County, white-tailed deer (Odocoileus virginianus) have proliferated under protected status on county-owned forest preserve sanctuaries. Exact deer numbers are not known, however on some sites, minimum densities have exceeded 39 deer/km2 (100 deer/mile2)--far in excess of the ability of the resource base to support such numbers on a sustained basis.

The consequences of large deer numbers are increased conflicts. In 1986, a record number of deer-vehicle accidents were reported on state-numbered highways in Cook (N=469) and Lake (N=250) counties. Total economic loss from these 719 deer-vehicle accidents was estimated at $1,064,551.00. Deer on O'Hare International Airport, near and on active runways, is an intolerable situation with potential for catastrophic loss of human life; a deer-United Airline 737 jet collision on 17 March 1987, caused no human injuries but resulted in over $114,000.00 in aircraft damage. High deer densities on some county forests

and state nature preserves have caused irreversable damage to native understory vegetation, and are noticeably impacting vegetation at other locations. Homeowners near forest preserves where deer are at high density, have sustained extensive browsing and antler damage to ornamental and garden plants. Lyme Disease, a serious bacterial infection transmitted to humans by a deer tick, prevalent in other urban areas and spreading in distribution in the United States, is of future concern.

The prognosis for deer-human conflicts in northeastern Illinois is continued increase if steps are not taken to control deer numbers. Over time, preserves will only become more compartmentalized because of peripheral suburban development, thus, increasing the frequency of negative deer-human interactions. Severe winters will temporally decrease deer abundance through high mortality from starvation, but this passive approach will be much more costly in social, political, ecological, and economic terms, than initiating a sustained preventative program of urban deer management.

STATUS OF RESOURCES NOW AVAILABLE

Present staffing of both lead agencies, the IDOC and the CCFPD, is inadequate to meet urban deer management needs. Two IDOC personnel, a District Wildlife Manager (based in DuPage County) and the Forest Game Supervisor (based in Springfield), are involved in urban deer management, but such work is not the principal duty of either. The CCFPD employees 23 naturalists that function primarily as public educators. However, the CCFPD has no staff wildlife biologist.

NEEDS AND GOALS

Wildlife and land resource agencies should possess high level professional expertise in urban deer ecology, public relations, and on-site management capabilities to address deer-related issues, if and when such actions are warranted. Suggested goals of urban deer management for northeastern Illinois are:

1) To facilitate cooperative management programs based on the principle that urban deer conflict resolution is best seen as a responsibility shared among state agencies, local governments, and the public.

2) To develop state-of-the-art expertise on urban wildlife management and local deer ecology that can be readily accessed for the purposes of public education, and to provide a basis for management evaluations.

3) To develop on-site staff capabilities necessary to reduce or mitigate deer-human-ecological conflicts in response to recognized needs of urban communities and local governments.

4) To increase public and local agency awareness of urban deer ecology and to promote more detailed understanding of the consequences of an urban environment shared with wildlife.

5) To promote and maintain a positive image for urban wildlife management.

AGENCY RESPONSIBILITIES

The Illinois Department of Conservation, as the legal custodian of non-migratory state wildlife, has partial responsibility for urban wildlife management. The Cook County Forest Preserve District, as principal landowner of deer habitat in Cook County, shares co-responsibility for urban deer management with the IDOC.

PROPOSED URBAN DEER (WILDLIFE) INITIATIVE

Personnel

A wildlife extension specialist is needed to coordinate

community involvement in urban deer management and to provide information and education to cooperating agencies, public, and media. An urban wildlife biologist/manager is needed to direct and implement management actions which include, but are not limited to, deer removal through live-trapping or lethal reduction, monitoring of habitat and deer demography, and coordinating cooperative research.

Funding

Each lead organization should make a substantial commitment for program support that clearly defines, and guarantees, multi-year program integrity. We suggest that an equitable division of IDOC:CCFPD funding be based on 60:40 contributions.

PROPOSED BUDGET

Cook County Forest Preserve District	
Direct funding for commodities, contractual services, transportation, equipment etc.	$25,000.00
Provide gasoline for 2 vehicles (@ $2,000.00 per vehicle annually)	4,000.00
Office space and utilities (equated @ $750.00 per month)	9,000.00
Logistic support (estimated value of support drawn from maintenance divisions and nature centers)	2,000.00
Subtotal (value of CCFPD contributions)	$40,000.00
Illinois Department of Conservation	
Direct funding for personnnel, commodities, contractual services, equipment etc.	$60,000.00
Total project budget per year	$100,000.00

ADMINISTRATIVE RESPONSIBILITY

Long term

Staff positions should be administered under one organizational structure. We suggest that the IDOC accept this responsibility which is consistent with it's role in wildlife management. Acceptance of this responsibility should be conditional on a guarantee of long-term support from the CCFPD.

Short term (if neccessary)

It is essential that an Urban Deer Management Program be implemented as soon as possible to provide overlap with the final stage of INHS Urban Deer Research scheduled to conclude on 30 June 1989. Interim contractual services could be used if one or both IDOC staff positions cannot be immediately established. Prairie chicken management at Bogota serves as a model where interim administration, provided by INHS, has been used for interim management.

BENEFITS-- A cooperative urban deer management program will:

1) Provide a unified coalition between state and county with shared goals on urban wildlife damage.

2) Provide on-site professional expertise on urban deer management that will be a source of information, education, and training.

3) Establish a system capable of mitigating deer damage, if and when actions are warranted.

4) Decrease agency costs relative to implementing a program independently.

5) Standardize means for addressing deer issues on county property, and will provide mechanisms for ecological monitoring and collection of new data.

6) Identify population and habitat trends that enable prediction of deer-related problems.

INTRODUCTION

Recognition of human need for open space as an integral land-use component of metropolitan areas (Levin 1987, Salwasser 1987, Schauman et al. 1987), has resulted in preservation of urban green belt systems that provide quality deer habitat within zones of intensively developed urban landscape. The provision of requisite habitat and the ability of deer to successfully colonize and proliferate on sites near human population centers have necessitated that urban deer management programs be considered for an increasing number of North American metropolitan areas (Appendix A).

There would be no controversy, or need for management, if deer interactions in an urban setting were benign. However, this is not the case. White-tailed deer (Odocoileus virginianus) are successful animals with adaptive characteristics that enable their exploitation of a wide range of successional habitat-types (Baker 1984). Literature is replete with examples of temporal overexploitation of forage resources by herds that increase to exceptionally high densities (Martin and Krefting 1953, Roseberry et al. 1969, Casey and Hein 1983, Ismael and Rongstad 1984, Wemmer and Stuwe 1985, and others). This "overshoot phenomenon" (McCullough 1984), cannot be sustained indefinitely. However, the inevitable decline in deer numbers is typically delayed well after the initial period of heavy impact on vegetation. The importance of this time lag is that when deer numbers persist at high levels, in excess of the habitat's capacity to support them, this magnifies degradation of local vegetation, which can

significantly increase frequencies of other deer-human conflicts.

Biotic and abiotic factors, independent of human control, can substantially influence fluctuations in local deer numbers. For example, a large mast crop that improves late summer-fall nutrition will cause does to be in better condition, increase productivity, and enhance over-winter survival. Similarly, mild winters that favor survival allow more subadults to reproduce the following year. Conversely, decimating factors such as severe winters and lower nutrition will increase mortality and result in lower numbers of deer. However, "good" and "bad" years rarely alternate in sequence, nor do they occur in balanced predictable patterns. Consequently, herd numbers can build and decline with inertia that is difficult to change over periods of a few years. The prevalent notion among the urban public that a "balance of nature" will maintain deer herd stability, particularly on small highly perturbed systems such as urban forest preserves, is parochial logic that largely ignores interannual herd dynamics and the resultant ecological and socio-economic consequences.

Public perceptions of deer are highly polarized. Some urban residents, particularly those that do not sustain deer-related property damage and have limited contact with wildlife, perceive deer as an extension of anthropomorphic animated creatures that are typically found in children's books and films. They view deer as benign, non-threatening herbivores that should be left in peace. Somewhere in the middle are conservation-oriented residents that see deer as a component of a system. They are concerned by impacts caused by deer, but are divided on what

actions should be taken because of differences in personal philosophies that range from protectionist to utilitarian. Sportsmen, who advocate consumptive use of wildlife resources through public hunting, represent the other extreme.

Consumptive use of deer as a renewable resource is a cornerstone of wildlife management in North America. Public firearm hunting is well recognized as a cost-effective method to regulate deer numbers in rural settings. However, in an urban environment where deer habitat is interspersed on human-dominated landscape, use of public hunting to limit deer numbers is strongly opposed by the urban majority. Opposition centers on concern for public safety, which is frequently integrated with philosophical positions that link and repudiate firearm use, hunting, and cruelty to animals.

The conflicting nature of deer in urban environments is relatively simple to summarize--even if management solutions are not. The presence of deer in urban environs is a product of local land-use decisions, which have placed high value on urban sanctuaries. Deer effectively utilize sanctuary resources and flourish because of their protected status. Under protected status, high deer numbers typically develop and can cause economic and ecological damage that often exceed human tolerance levels. Effective damage abatement can be achieved by a reduction in deer numbers, yet public hunting, a traditional cost-effective management tool used to regulate deer herds, is opposed by urban publics. With more intensive and costly effort, less efficient management tools can reduce negative interactions on areas of limited size, but are generally not feasible for

broad scale applications. Realistic answers to urban deer conflicts are not easily determined. Perhaps it is an understatement to say that urban deer management represents a major wildlife management challenge--one in which success hinges on a complex blend of ecological, political, and socio-economic factors. Irregardless of final solutions, management will have to be a continuing, probably annual effort, so long as habitat exists and deer have access to that habitat.

In this paper we suggest a framework on which to initiate a program of urban deer management for northeastern Illinois. The Illinois Natural History Survey (INHS) has studied urban deer conflicts in the Greater Chicago metropolitan area since 1983 and will complete it's stated research objectives in June 1989. This paper is not intended as a summary of INHS Urban Deer Study achievements, nor does it address specific research objectives. Development of an urban deer management structure is critically important but independent of INHS research objectives. However, we conclude that new initiatives will be necessary to implement final management recommendations because the scope of urban deer conflicts in the Chicago Metropolitan area far exceeds extant personnel commitments now available from local wildlife and land resource agencies. Provision of preliminary management recommendations, prior to research project completion, is done for the benefit of principal agencies to provide them lead time to develop, propose, and evaluate possible new initiatives on cooperative urban deer management within their respective systems.

It is essential that an interagency cooperative urban deer management structure be in place and operational before the research program ends. The INHS Urban Deer Study was specifically designed as a precursor to management with the intent that implementation of management would overlap the final phase of research. By this overlap, management personnel would benefit from INHS's guidance and experience, which will help eliminate costly mistakes that can delay and reduce effectiveness of future programs. In the sections that follow we:

- Describe urban deer habitat in Cook County
- Develop a perspective on current deer-human conflicts
- Assess extant deer management
- Develop the role of research as a precursor to urban deer management
- List specific management needs and goals
- Propose an organizational structure for the management of urban deer
- List benefits derived from the implementation of an urban deer management program in northeastern Illinois (Cook County)

PRESERVATION OF DEER HABITAT IN COOK COUNTY

Habitat preservation and restoration are key factors that have enabled deer herds to become reestablished in highly developed sections of northeastern Illinois. Since 1915, county governments have acquired large sections of non-developed and rural landscape for the "purpose of protecting and preserving the flora, fauna, and scenic beauties ... in their natural state and condition, for ... the education, pleasure and recreation of the public (Wendling et al. 1981)." County forest preserves

form the nucleus of primary deer habitat in northeastern Illinois.

The Cook County Forest Preserve District (CCFPD) is one of the oldest and largest county forest preserve systems in the United States. It is a mozaic of over 30 discrete refuges (range 16-6,070 ha) that comprise almost 12% (27,080 ha) of Cook County landscape. About 20% of CCFPD land has been developed for educational and recreational uses, which include 5 nature centers, Brookfield Zoo, Chicago Botanical Gardens, and an extensive system of maintained picnic and recreation sites. Non-developed properties are a diverse mixture of native hardwood forests, reforestations, riparian systems, old field succession, and leased agricultural fields. The general design of larger forest preserve properties involves concentration of human recreational impacts on peripheral sites and reduced access to interior sections.

Forest preserve properties vary in their degree of insularity. Private lands adjacent to forest preserves, particularly in north and central Cook County, have been extensively developed for residential, commercial, and industrial uses. In these areas, the interface between preserve and private property remains unfenced, although, a distinct line of demarcation is clearly evident by differences in land use. Deer concentrate on preserves but will readily cross heavily used roads to utilize resources on adjacent properties. Urban forest preserves will only become more insular over time. This will contribute to continuance, and perhaps escalation, of deer-human

conflicts in Cook County

DEER-HUMAN CONFLICTS

An increasing number of North American cities and special use areas (i.e., airports, arboretums, state parks and others) experience increasing frequencies of deer-human conflicts. However, to the best of our knowledge, deer-human conflicts in the Chicago metropolitan area represent an extreme because of high frequency of occurrence and wide dispersion of incidents. No metropolitan area compares with Cook County in magnitude and breadth of deer-human interactions--an urban environment where literally thousands of deer coexist among millions of people.

Reference to "the deer problem" in northeastern Illinois is frequently made as if it were a singular entity. This approach is convenient for brevity, but yields an oversimplified impression of extant deer-human conflicts. "The deer problem" in northeastern Illinois is not of singular type, nor one highly restricted in area. Instead, deer problems are a set of basic conflict types, spatially distributed across a broad area, that are uniquely influenced by site-specific conditions--conditions that change over time.

Reduced to the simplest divisions, there are 3 primary types of deer-human conflicts that occur repeatedly in urban environments. These include impact on plants through browsing or antler rubbing, spatial conflicts that cause accidents and/or general disruption of normal human activities and transmission of diseases. Although many site specific variations exist, all deer-related conflicts thus far identified in northeastern

Illinois are of the aforementioned three types:

Damage to plants

Damage to ornamental plants. Most extensive damage has occurred in northcentral and northeastern Cook County on properties near the Des Plaines River and the North Branch of the Chicago River. Browsing damage has been reported in northwest/central/southern Cook County, southeast and northeast Lake County, and DuPage County--Waterfall Glen Preserve (Table 1).

Damage to native and restored plant communities. Most obvious on forest preserves with high density deer herds-- Des Plaines River and Ned Brown Preserves in northern Cook County. Severe damage on Busse Woods State Nature Preserve, a 440 ac site, located on Ned Brown Preserve. Evidence of increased damage reported for Palos-Sag Valley in central Cook County (Dring, CCFPD, pers. commun.) and Ryerson Conservation Area near the Des Plaines River in southern Lake County (Brouillard, Lake Co. For. Pres. Distr., pers. commun.). Impact on native plant communities is also strongly suspected on Waterfall Glen Preserve, DuPage County.

Damage to plant collections. Arboreta have reported moderate damage from browsing and antler rubbing. A modest number of deer occupy Morton Arboretum and adjacent DuPage County Hidden Valley Forest Preserve. The Chicago Botanical Gardens in northeastern Cook County, located on forest preserve property near Skokie Lagoons/Chicago River north branch, has reported moderate deer browsing damage.

Spatial conflicts

Deer-vehicle accidents. Cook (N=469), Lake (N=250), Kane (N=124), and DuPage (N=76) counties rank 1st, 2nd, 8th, and 21st, respectively, for reported deer-vehicle accidents on state numbered highways in 1986 (unpubl. Illinois Dep. Transportation report) (Table 2). Fifty-three people were injured in deer-vehicle accidents in the 4-county area during 1986. Average economic loss per accident during 1986 was $1,480.60 (INHS, unpubl. data).

Deer-aircraft accidents. Two deer have been struck and killed by commercial airline jets (31 March 1982 and 17 March 1987) on O'Hare International Airport. Cost of repair exceeded $114,000.00 for the 1987 accident. Suitable habitat on O'Hare property adjacent to runway 14R/32L sustains a resident deer herd thought to be supplemented by occassional immigration from Des Plaines River herds (Indian Boundary Division). A minimum of 37 deer were counted near runway 14R/32L by aerial census during March 1987. Deer have also been reported on or near active runways at Glenview Naval Air Base, Midway Airport, and Palwaukee Airport in Cook County.

Deer in unusual locations. Individual deer frequently disperse into areas that are intensively developed. Dispersal frequently results in accidental death or injury to deer. Highest frequency of incidents occurs annually during spring. Between April-June 1987, displaced deer were reported to INHS: Arlington Park Race Track, Buffalo Grove, Chicago Animal Control (N=12 separate deer), Cook County Department of Animal Control, Glenview, Northbrook, Northwestern University, Palatine, Rolling Meadows, Wheeling, and numerous private citizens.

Disease transmission

California encephalitis var. Jamestown Canyon virus. Serology of all adult deer tested in northern Cook County has been positive for exposure to J.C. virus (P. Grimstad, pers. commun.). However, the IDOC currently feels that J.C. virus is of little concern to northeastern Illinois residents (T. Miller, IDOC, pers. commun.).

Lyme Disease. Lyme disease has received recent attention in scientific and popular articles (Warner 1986, Woolf 1986, Miller 1987). Lyme Disease has been reported in more than 20 states and at least 19 countries on 3 continents. High incidence was found in southern Wisconsin deer herds. A bacterial (spirochete Borrelia burgdorferi) infection transmitted by the deer tick (Ixodes dammini), manifests arthritic, heart inflammation, and nervous system dysfunction. No known records exist for northeastern Illinois (August 1987), although, the large number of urban deer interacting with a dense human population, represents an ideal situation for disease transmission.

Babesiosis. Transmitted by deer tick, babesiosis (Babesia microti) symptoms resemble malaria. Frequently isolated from ticks that also carry Lyme disease. First case reported in Wisconsin in 1985. No known records in northeastern Illinois (August 1987).

A fourth conflict type, collectively termed secondary conflicts, has extreme effects on urban deer management. Secondary conflicts involve public perception/opinion of management decisions and actions. Single incidents that are poorly handled can inflict long-term damage to program credibility. Poor judgment displayed by ill-prepared professionals during traumatic incidents, such as injured or displaced deer situations, are often magnified to highly

detrimental proportions by public and media. Even well-planned management actions have potential for controversy because of polarity and intensity of public and media opinion on deer issues. Awareness and control of secondary conflicts are as critical to program success as is the direct management of urban deer. Public criticism should always be anticipated and prepared for in advance. Preparation will help a manager or an agency maintain a positive position, rather than being forced into a negative or reactive response.

Secondary conflicts

Incidents that involve injured deer

Over 50 injured deer were handled by INHS personnel, without major incident, from 1984 through 1986. The majority resulted from deer-vehicle collisions when deer sustained fractured legs and non-lethal internal injuries. Observation of a large, struggling, bloody animal, often with twisted limbs, is an emotionally traumatic experience for most people. Over time, we recognized that injured deer situations involved two major problems that needed to be assessed and controlled. Readily apparent was need for humane and efficient handling of the injured deer. However less obvious, was recognition that the individuals present, including some police officers, typically experienced emotional trauma which influenced their behavior and ability to make rational assessments.

Malnourished deer and winter mortalities

As a rule, in both rural and urban environments, deer mortality is high during severe winters with extended periods of low temperature or deep snow. In general, individual animals die unnoticed in rural settings. However, urban forest preserves are extensively used by humans for winter recreation which increases probability that people will find carcasses or animals in weakened condition. Public factions address winter dieoffs according to their own special interests, and ill-prepared agencies may be pressured into reactive positions. Public-offered "solutions" range from artificial feeding and translocation to condemnation by some sportsmen who view deer mortality as a wasted resource that should have been utilized via annual hunting. The last episode of high winter mortality in northeastern Illinois during the early 1980's contributed significantly to the

decision to conduct research on urban deer herds (T. Miller, IDOC, pers. commun.). Since that time, herds have increased in size, aided by the consecutive mild winters of 1985-86 and 1986-87. There is current need for management agencies to discuss and prepare responses prior to future winter dieoffs which will surely occur in the next few years.

STATUS OF DEER MANAGEMENT IN COOK COUNTY

Illinois Department of Conservation

Two personnel are currently involved in deer management activities in Cook County. Such work is not, however, the principal duty of either. A District Wildlife Manager (DWM), responsible for a 5-county-area and based in DuPage County, responds to property owner complaints on deer browsing damage. The IDOC Forest Game Supervisor/state deer biologist (FGS), headquartered in Springfield, issues Nusiance Deer Removal permits and generally functions in an advisory capacity on urban deer issues. Pittman-Robertson funds administered by the FGS supported the INHS Urban Deer Research Project from 1983 to the present.

Exclusive of INHS research activities, we know of only one attempt in Cook County to manage a deer herd by direct removal. In 1982-83, following a deer-aircraft collision at O'Hare International Airport, the IDOC and U.S. Fish and Wildlife Service implemented a series of herd reduction efforts in which a total of 22-23 deer were removed from O'Hare property by shooting. Between 1983 and 1987, O'Hare personnel live-trapped deer in an attempt to offset herd increase. Their efforts were clearly ineffective as only 3-5 deer (Gebhardt, O'Hare, pers. commun.) were captured and translocated. A minimum of 37 deer were counted on O'Hare property in March 1987 (INHS, unpubl.

data).

Cook County Forest Preserve District

The CCFPD employees 23 naturalists dispersed county-wide among 7 locations (CCFPD Conserv. Dep., pers. commun.). As a group, the naturalist staff provides skilled nature interpretation and possesses excellent communicative abilities in their primary role as public educators. The CCFPD does not directly manage deer, although, land use decisions that influence availability and quality of deer habitat profoundly affects demography of the local deer herds.

Carcass disposal and consumptive use of deer

Deer carcasses on public highways are removed by the Illinois Department of Transportation (state highways), Cook County Highway Department (county roads), and township and municipal road maintenance crews. The IDOC allows the general public to salvage carcasses of deer killed by vehicles. The claimant must contact an IDOC regional office within 24 hours of carcass possession.

Cook, DuPage, Kane, and Lake counties have remained closed to public firearm hunting for deer. Archery hunting for deer on private land is permitted by the IDOC in all Illinois counties. A 1964 Cook County ordinance that prohibits archery hunting for deer is in conflict with state regulations (Dziedzina 1984). A limited number of deer are killed annually by archers hunting on private land in Cook County (reported kill during 1986: 12 bucks and 3 does; unpubl. data, IDOC).

THE INHS URBAN DEER STUDY: A PRECUSOR TO MANAGEMENT

Background

Prior to 1983, deer herds in northeastern Illinois had never been intensively studied. To our knowledge, neither the IDOC north the CCFPD have historic records of comprehensive censuses, or related demographic data, for deer in Cook County. The most valuable data collected on deer herds prior to 1983 include: 1) deer-vehicle accident records for state numbered highways from 1975-present (Illinois Department of Transportation, unpubl. data), and 2) records from deer carcass examinations (weight, sex, age, & location) performed by naturalists at the River Trail Nature Center naturalists (CCFPD) in the late 1960's and early 1970's (Schwarz, CCFPD, unpubl. data).

In early 1983, the IDOC contracted with the Illinois Natural History Survey for a study of white-tailed deer ecology, deer-human interactions, and management options in northeastern Illinois. Research emphasis was guided by anticipated future management needs that included: 1) collection of baseline data to establish herd and habitat profiles, 2) assessment of deer-human interactions, 3) evaluation of alternative management strategies, 4) development of interagency cooperation, 5) public awareness and participation, and 6) pilot studies to explore issues and to establish management precedents (see project objectives, Appendix B).

Accomplishments

The first 4 years of research were successful. Preliminary baseline data were collected, deer-related damage was assessed,

cooperative contacts among agencies and the public were developed, and experimental manipulation of a high density herd was initiated.

Benefits derived from the use of research as a precursor to management extend beyond the final written products that will address research objectives. The presence of state sponsored research has temporally filled a management void and is considered to be a response by the IDOC to public needs--as yet, however, no permanent actions have been taken. Progress has been made in developing cooperative community support of programs, establishing precedence in areas of controversy, and in testing elements of program structure:

Local cooperation and direct participation - Viewed as a risk among management agencies, the success of urban deer management is dependent on shared responsibility among state and local governments, private organizations, and the public. The prevailing cooperative attitudes among agencies and individuals has evolved over time and should be regarded as a base on which to establish a future program of deer management.

Example: An IDOC committment to fund 6-year urban deer research program.

Example: Cook County Forest Preserve District, cooperator from project inception, offered logistic support, office space, and financial support for Busse Woods deer reduction program.

Example: Illinois Nature Preserves Commission, offered additional financial support for Busse Woods deer reduction program.

Example: A carcass collection program that involved network of 89 agencies/individuals that reported locations of carcasses over a 23-month period.

Example: Assistance of > 200 public volunteers used to handle deer during live-capture, mark, and release activities. Large groups of individuals (> 25) assembled for trap and translocation, and drives.

Example: Establishment of a Community Liason Committee that links Urban Deer program to the public through community leaders

Example: Cooperative nutritional assessment research with Brookfield Zoo and Michigan State University staff.

Precedence establishment - Actions once established are accepted more readily than new initiatives.

Example: Herd reduction on Busse Woods Nature Preserve represents capability of management to reduce and control maintain herd size, when and if, such actions are warranted.

Example: Donation of carcasses for human consumption. Agencies would receive severe criticism if carcasses of deer culled during herd reduction were not used. On a pilot study venison from 52 deer was donated to charitable organizations for human consumption.

Pretest of management structure - Successful elements of research programs can be emulated by management.

Example: One project spokesperson, central source of consistent information. On-site knowledge that is current, reliable, and sensitive to local conditions.

Example: Two person management team. Division of responsibilities into high profile public contact and low profile field emphasis is ideally suited to address program goals and objectives.

Example: Interagency cooperative support.

Example: Preparation of written news releases in advance of potentially controversial activities. Release made only when and if necessary, usually after-the-fact.

On-site presence and lag-time - Research program has provided the time necessary for state and county governments to evaluate options without becoming locked into firm management commitments. On-site presence of deer biologists has filled a personnel void when temporal responses to the public were desired.

Example: IDOC and CCFPD routinely refer public and media to INHS to answer questions on deer/wildlife conflicts.

Example: IDOC forwarded deer damage complaints to INHS as potential sites for research on removal.

PROGRAM NEEDS AND GOALS

Management of urban deer herds is a choice that is largely determined by community tolerance for deer-related conflicts. The collective responsibility of wildlife and land resource agencies is to be a working extension of public and community needs. To accomplish this, it is essential that state and county governments possess high level professional expertise in all aspects of urban deer ecology, public relations, and on-site management capabilities to address deer-related issues if and when such actions are warranted. Present staffing is inadequate to meet current needs.

NEED: DEVELOP ON SITE STATE-OF-THE-ART EXPERTISE ON URBAN DEER ECOLOGY AND MANAGEMENT

NEED: POSSESS ON SITE CAPABILITY TO EVALUATE AND PERFORM MANAGEMENT RESPONSES NECESSARY TO REDUCE OR MITIGATE DEER-HUMAN CONFLICTS

Management of urban deer is a responsibility that must be shared among state and local governments, and the public. No single agency can effectively perform all duties necessary to mitigate urban deer conflicts. Therefore, efforts to improve or facilitate capabilities of other organizations (indirect management) are as important as activities that are directly involved with the management of urban deer. Lead agencies will need to develop cooperative programs that utilize the wide range of available local resources and to promote a community philosophy of shared responsibilty.

NEED: DEVELOP COOPERATION AMONG LEAD AGENCIES, LOCAL GOVERNMENTS, AND THE PUBLIC IN ADDRESSING DEER MANAGEMENT ISSUES

It is not practical for an urban deer management program to be directly involved in all crises relating to individual animals. Deer are injured and/or found in unusual locations almost daily across the Greater Chicago Metropolitan area. It would be logistically impossible to provide adequate and timely response to every situation from a single central location.

Injured and displaced deer incidents are almost always reported first to municipal police departments. Village, county, and state police departments are the agencies best suited to handle routine emergency situations because they have: 1) the first officials present at an accident scene, 2) directional authority over the public, 3) experience in working with people under stress, 4) direct radio communication with a dispatcher, and 5) authority to discharge a weapon if necessary to dispatch an injured deer. Many municipalities have animal control wardens as a part of their law enforcement, although most are not available at night, and few are prepared to handle injured wildlife the size of deer.

Clearly, there is a continuing need to work with local police to improve and maintain their ability to handle situations that involve injured and displaced deer. The role of the Urban Deer Management Program would be to assess extant response capabilities and provide technical information including seminars or training to improve these capabilities. We believe that a computerized system could be developed that would help identify jurisdictional response for all areas in Cook County. Ultimately, the scope of this network could be expanded to include other forms of wildlife problems.

NEED: ASSESS CAPABILITIES OF MUNICIPALITIES TO HANDLE INJURED OR DISPLACED DEER

NEED: FACILITATE NEEDS OF MUNICIPALITIES IN HANDLING INJURED OR DISPLACED DEER THROUGH INDIRECT MANAGEMENT (INFORMATION, EDUCATION, AND EXTENSION).

The INHS Urban Deer Study was initiated in 1983, in part to establish a data base on local deer herds from which management decisions could be derived. Deer numbers and habitat resources will change over time thereby necessitating the need to continually update data collection. Provisions to monitor environmental factors such as population parameters, habitat conditions, and deer-related damage are a necessary on-going function of urban deer management.

NEED: LONG TERM DATA COLLECTION ON LOCAL DEER HERDS AND HABITATS

Urban deer management is not unique to Chicago--other regions are, and will be, facing similar deer-human conflicts. Much can be learned through contact with deer managers as they address their own site-specific problems in other areas. Thus, there is a need to identify key individuals involved in management of urban deer herds and to develop means for periodic contact to enhance exchange of information and experiences. Since the start of the INHS Urban Deer study, we have been contacted by urban deer biologists/managers from Boulder, Colorado; Cleveland, Ohio; Connecticut, Madison, Wisconsin; Midland, Michigan; Milwaukee, Wisconsin; Minneapolis, Minnesota; New York, Texas, and Winnipeg, Canada. There is an outstanding opportunity to learn from other urban deer management situations,

and, perhaps, to take the lead to coordinate an information exchange among these widely dispersed regions.

NEED: COORDINATE INTERACTION AMONG OTHER URBAN DEER PROGRAMS

A majority of urban residents do not sustain wildlife damage to personal property. Most are relatively naive about deer impacts to "community-owned" property such as floral and faunal resources on local sanctuaries. Attitudes and perceptions of these "non-affected" constituents can have a major influence on any management program. Therefore, the need to improve public awareness of deer damage, ecology, deer-human conflicts, and the wildlife resource as a whole, should be an integral component of an urban deer management program.

NEED: IMPROVE PUBLIC AWARENESS OF DEER ECOLOGY AND RELATED CONFLICTS

Attempts to resolve deer-human conflicts are potentially controversial. An urban deer management program should purposefully incorporate positive elements in such programs that will help offset any negative influences. Opportunities to expand a deer management program into a broader urban wildlife program should be considered as a long-term goal.

NEED: TO MAINTAIN A POSITIVE PROGRAM IMAGE

NEED: TO EXPAND FROM URBAN DEER CONFLICT RESOLUTION INTO A COMPREHENSIVE URBAN WILDLIFE PROGRAM

Urban deer management needs can be restructured into the following long-term goals:

- To facilitate cooperative management programs based on the principle that urban deer conflict resolution is a responsibility shared among state agencies, local governments, and the public.

- To develop state-of-the-art expertise on urban wildlife management and local deer ecology that can be readily accessed for the purposes of public education, and to provide a basis for management evaluations.

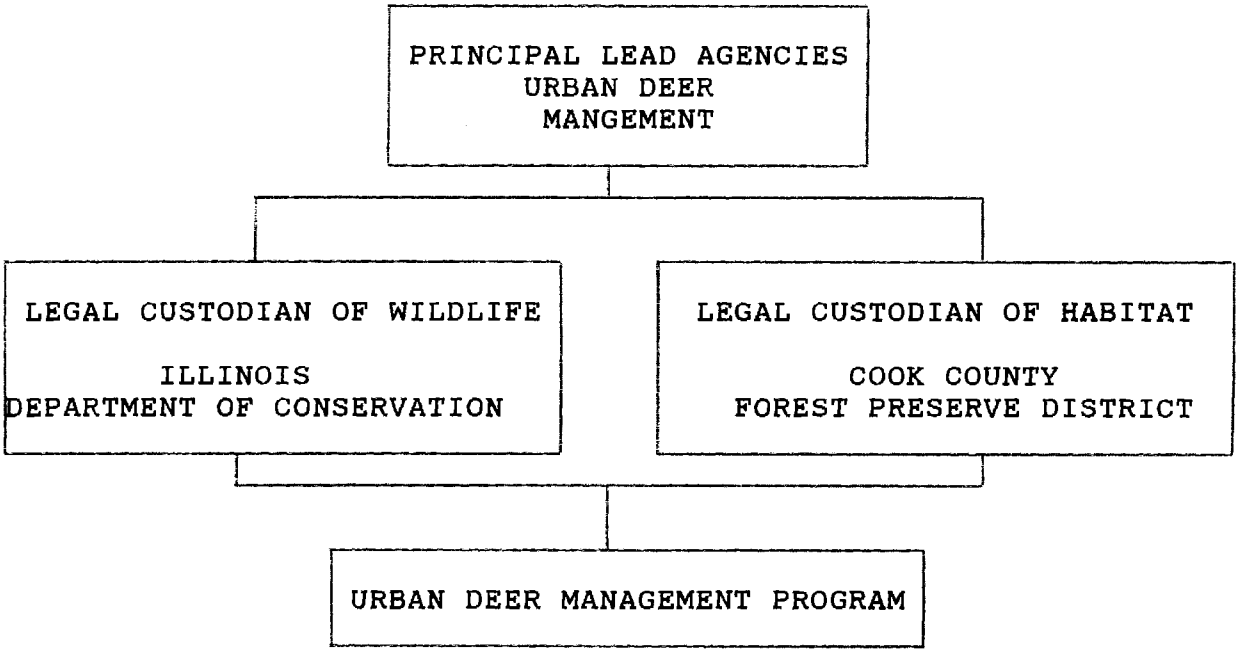
- To develop on-site staff capabilities necessary to reduce or mitigate deer-human-ecological conflicts in response to deer-related problesm of urban communities and local governments.

- To increase public and local agency awareness of urban deer ecology and to promote broader understanding of the consequences of an urban environment shared with wildlife.

- To develop and maintain a positive image for wildlife management.

URBAN DEER MANAGEMENT PROGRAM STRUCTURE

We stress that solving urban deer problems is a community obligation, yet there is need for lead agencies to coordinate and focus community efforts. Responsibility rests with the state wildlife agency and the principal owners of land where deer reside. The Illinois Department of Conservation (IDOC) is legal custodian of non-migratory wildlife and clearly has partial responsibility for urban deer management. In Cook County, the forest preserve district administers properties that total 12% of county landscape. Forest preserve sanctuaries are the primary locations of habitat that sustains large deer herds. Therefore, as principal landowner of deer habitat, the CCFPD shares co-responsibility with the IDOC as lead agencies for the managemenet of urban deer in Cook County.



The urban deer management team that we prepose should be partitioned into two basic areas of staff responsibility in order to achieve program goals. The first set of duties involves indirect management of deer--actions that will facilitate more professional and efficient handling of deer problems at municipal and private citizen levels. The second set of activities involve direct management--deer management actions that cannot, or should not, be delegated to other organizations or individuals such as the control and monitoring of deer herds on selected county forest preserves.

Indirect management will be a key element in meeting program goals and coordinating community involvement and understanding. The major function of indirect management is urban wildlife extension:

- Facilitate municipal responses to deer-related crises

  a) Assess response capabilities of municipalities
  b) Coordinate training of municipality personnel
  c) Network information transfer among municipalities

- Provide information and education to cooperating agencies public and media

  a) Accumulate and update technical expertise
  b) Survey public opinion on selected issues
  c) High profile single program spokesperson

- Unify information transfer among urban deer management and research programs in North America

- To supervise direct management activities

- To explore special projects in urban wildlife management that will benefit the wildlife resource, educate the public, and enhance program image

Direct management is an essential program component, not necessarily because it will be used in all cases, but because the choice to exercise management options should remain readily available. Furthermore, control programs such as herd reduction on Busse Woods Nature Preserve, require long-term ecological monitoring with periodic adjustments in herd size. The major function of direct management is to affect solutions to deer-related problems on county forest preserves and adjacent private property:

- Proficiency and experience in deer removal

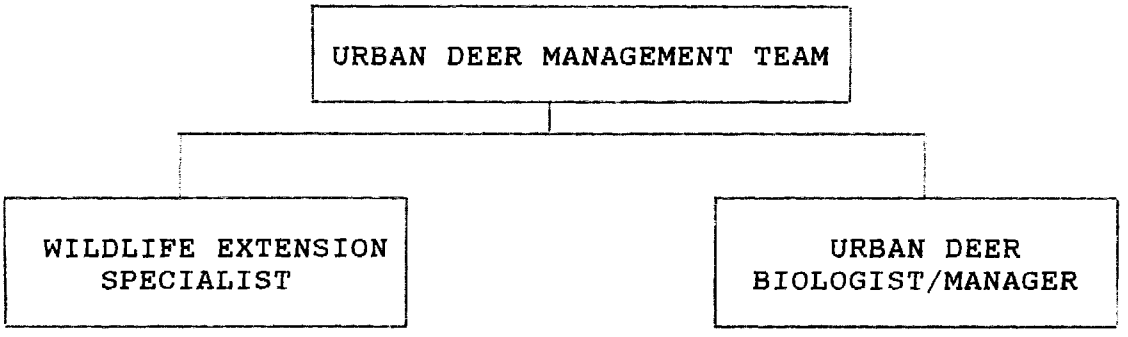
  a) Live capture
  b) Lethal removal

- Coordinate deer translocation and carcass disposition

- Expertise in non-lethal techniques to reduce damage

  a) Barriers
  b) Repellents

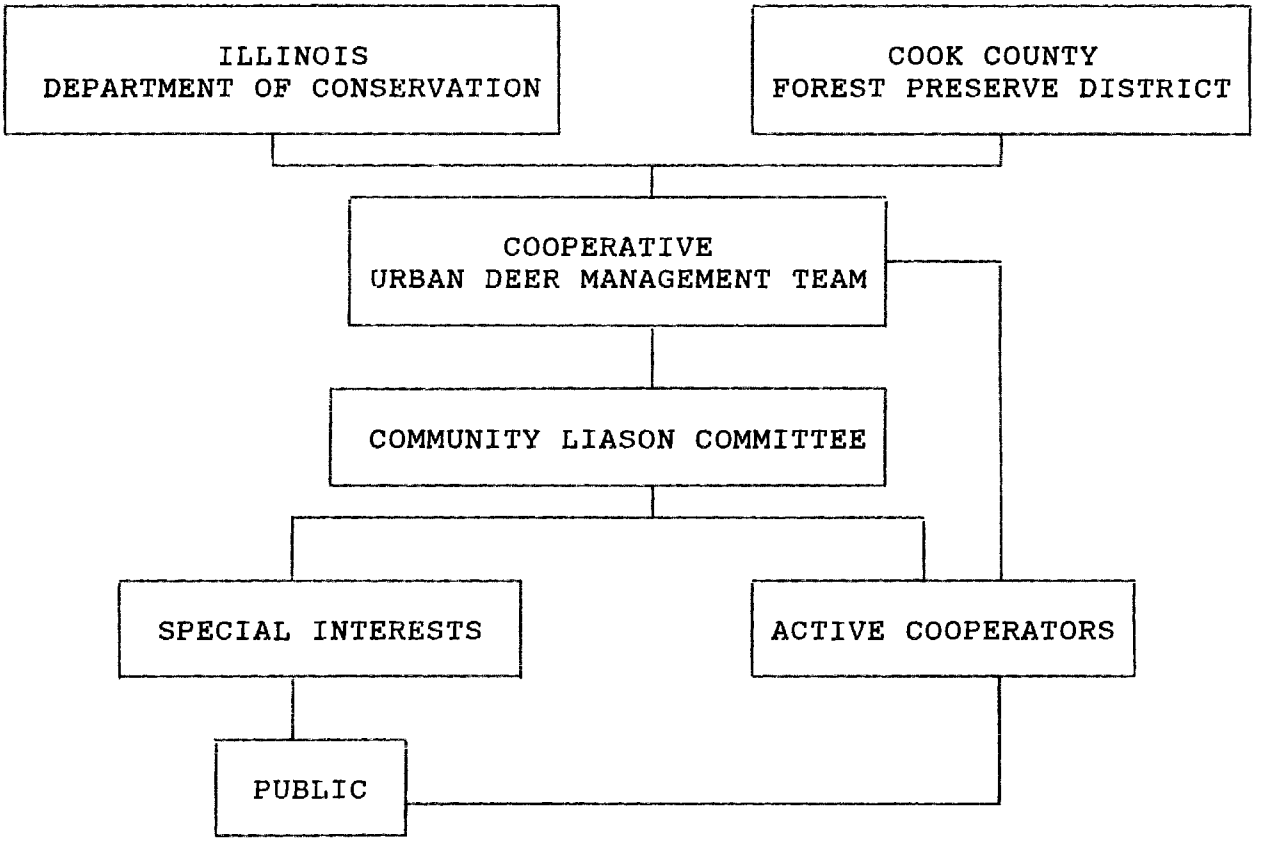
- o Ecological monitoring
    - a) Vegetation status
    - b) Herd demography
- o Computer data entry and statistical analyses
- o Coordinate cooperative research



Cook County has over 5 million human residents--each with a different voice. Each resident should have the means to express his or her concerns on management of urban deer. Also, there is need to disseminate information to those individuals in the community with expressed interest in urban deer management. Obviously, an urban deer management team cannot interact with every such person. The INHS Urban Deer study has successfully interacted with a Community Liason Committee (Table 3) and has found it to be a useful organizational structure and one that could help meet the need for 2-way communication.

We suggest that a similar committee, composed of upper level administrators from organizations that have interests in urban deer management, be assembled to provide an advisory function as a part of the urban deer management program organizational structure. The "Urban Deer Management Committee" should represent a wide spectrum of interests and philosophies,

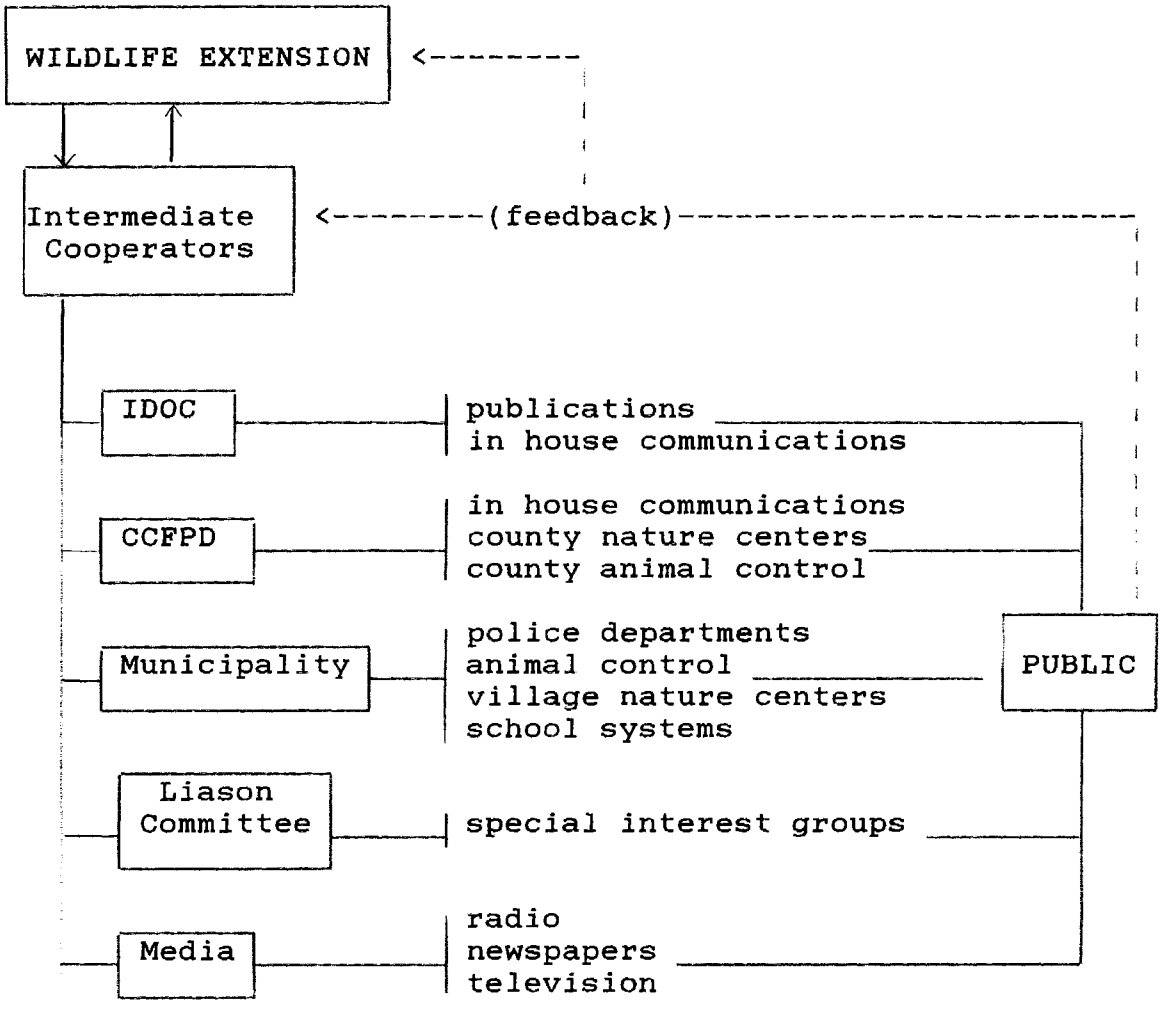
and should function in an advisory capacity only. Final authority for decisions and actions should remain with lead agencies. The shift from research to management offers opportunity to retain the current Liason Committee, or reorganize committee composition as desired.



Possible routes of information transfer

Cooperative wildlife extension programs have traditionally been based on individual and small group contacts. However, a much broader scale of public contact would be necessary for urban wildlife extension needs. To this end, efforts should be made to use information transfer systems that are already established. Greater efficiency will be achieved when information can be

routed through intermediate cooperators. The following example lists some of the potential routes of information transfer:



Herd reduction-- a community supported decision

Herd reduction and subsequent control should not be attempted without adequate community support. Potential conflicts should first be acknowledged at community or agency levels before any action is taken. Deer may have a substantial impact on community resources, but if the community in general does not perceive a problem, then there is no basis of public on which to implement management actions. On deer issues, one

should not expect agreement among all individuals. However, it is not necessary to have majority support--only consensus. Perhaps, the best measurement of community recognition of a deer problem is whether or not the constituents that sustain deer damage have convinced community leaders to publically support efforts to mitigate the damage. If this level of community support is attained there is basis to evaluate alternative management actions.

Herd reduction by INHS on Busse Woods Nature Preserve provides an example of recognition of a deer problem by the community, and community support for resolution of the problem:

- Demographic and ecological baseline data were collected

  In 1983-1984, INHS Urban Deer study personnel identified 2 sites (Busse Woods and northern Des Plaines River forest preserves) in Cook County, where vegetation was severely impacted by high deer densities. Baseline data were collected on herd demography, physical condition, vegetation, and deer-related impacts. The landowner (CCFPD) and IDOC were apprised of herd and habitat conditions.

- Public recognition of a problem

  In spring/summer 1985, Mr. George Fell, Natural Land Institute, identified severe vegetation degradation at Busse Woods Nature Preserve and suggested to the Illinois Nature Preserves Commission (INPC) that deer exclusion was necessary to restore floral composition on the highly impacted preserve. The landowner (CCFPD) evaluated construction/maintenance costs of fence and solicited opinions from wildlife professionals on fence effectiveness. The CCFPD decided that fence construction was not a cost-effective solution to reduce deer browsing impacts.

- Support from community leaders

  In August 1985, the INPC toured Busse Woods Nature Preserve andto observed deer-caused impacts to vegetation. The tour was followed by strong INPC support for herd reduction.

- Development of herd reduction plan, objectives, and decision rule

  In August 1985, the INHS Urban Deer Study proposed an experimental herd reduction that included 3 objectives:

  To reduce deer browsing pressure to level that allows for plant understory regeneration
  To significantly reduce deer-vehicle collisions on adjacent highways
  To significantly improve average deer condition

  A decision rule was adopted to maintain deer density at or below 8 deer/km2 (20 deer/mile2).

- Multi-agency cooperative support

  Cooperative funding for herd control was provided by the IDOC, CCFPD, and INPC. Herd reduction plans were discussed at a Community Liason Committee meeting.

- Implementation of herd reduction

  Over a 2-year-period, October 1985-April 1987, 259 deer were removed from Busse Woods Nature Preserve and adjacent areas by INHS personnel.

- Evaluation

  INHS personnel established permanent transects and plots to quantify vegetation responses to lowered browsing pressure. Deer-vehicle accidents were summarized annually from records of police departments adjacent to Busse Woods. Herd condition was monitored through postmortem evaluations of collected deer. Aerial counts were conducted annually.

- Annual control and long-term monitoring

  Provisions were made by INHS to control herd size and monitor vegetation, vehicle accidents, and deer condition until completion of research in July 1989.

Suggested division of responsibility among lead agencies

These recommendations are based on the assumption that all funding for an urban deer management program will be shared by lead agencies (i.e., IDOC and CCFPD). We recognize that the actual division of any funding would be negotiated. The critical point is that each organization would make a substantial

commitment for program support. The commonly raised argument of "who is responsible" for urban deer management is irrelevant in that the typical urban resident does not differentiate between state and county. Both agencies sit in the same "conservation pot" in the eyes of the public. A positive relationship can only be developed if agencies recognize that effective urban deer management can be best achieved through mutual trust, and with contributions that are equitable, and clearly defined. It is essential that lead agencies recognize the positive benefits attainable only through their shared cooperation.

Two staff positions are called for and need to be administered by one organizational structure; we suggest that the IDOC accepts this administrative responsibility. This would be consistent with the IDOC's current role in funding INHS research and consistent with the IDOC's normal role and expertise in wildlife management. If permanent positions cannot be established, perhaps because of head-count limitations, then use of contractual services should be investigated for an interim period until permanent positions can be established.

It is reasonable that long-term contributions of CCFPD would also be similar to the support that it has provided to the INHS Urban Deer Study. Specifically, the CCFPD has provided 1) office space, 2) a one-year, $22,000.00 contract for deer herd reduction, and 3) occasional logistic support as needed.

The IDOC is best qualified to estimate costs needed to support an urban deer management program. For the purpose of suggesting initial contributions for lead agencies, we estimate that program costs would be about $100,000.00 per year. An

equitable division of IDOC:CCFPD support would approximate a 60:40 ratio. Cooperative support should be predicated on multi-year agreements that guarantee funding for minimum periods of 3-5 years.

Cook County Forest Preserve District

Direct funding	$ 25,000.00
Fuel for 2 vehicles	4,000.00
Office space at CCFPD facility credit	8,000.00
Logistic support credit	3,000.00
Subtotal	**$ 40,000.00**
Illinois Department of Conservation	**$ 60,000.00**
Total project budget per year	$100,000.00

Potential benefits from a cooperative urban deer management

A cooperative urban deer management program will provide a unified coalition between state and county with shared goals on urban wildlife damage abatement. On-site professionals will be capable of mitigating deer damage, if and when actions are warranted. A cooperative urban deer program will standardize means for addressing deer issues on county property, and will provide mechanisms for ecological monitoring and collection of new data. Such data, will identify population and habitat trends that will help predict future deer-related problems.

LITERATURE CITED

Baker, R.H. 1984. Origin, classification and distribution. Pages 1-18 in L.K. Halls, ed. White-tailed deer, ecology and management. Stackpole Books, Harrisburg, Pa. 870pp.

Casey, D., and D. Hein. 1983. Effects of heavy browsing on a bird community in a deciduous forest. J. Wildl. Manage. 47:829-836.

Dziedzina, D. 1984. Bowhunting for deer prohibited in Cook County. Outdoor Notebook 4:28.

Ismael, W.E., and O.J. Rongstad. 1984. Economics of an urban deer removal program. Wildl. Soc. Bull. 12:394-398.

Levin, M.R. 1987. Planning with nature: alternative approaches. Pages 9-10 in L.W. Adams and D.L. Leedy (eds.), Integrating Man and Nature in the Metropolitan Environment. Proc. National. Sym. Urban Wildl., Chevy Chase, Maryland, November 1986. 249pp.

Martin, F.R., and L.W. Krefting. 1953. The Necedah Refuge deer irruption. J. Wildl. Manage. 17:166-176.

McCullough, D.R. 1984. Lessons from the George Reserve, Michigan. Pages 211-242 in L.K. Halls, ed. White-tailed deer, ecology and management. Stackpole Books, Harrisburg, Pa. 870pp.

Miller, J.A. 1987. Ecology of a new disease. BioScience 37:11-15.

Roseberry, J.L., D.C. Autry, W.D. Klimstra, and L.A. Mehrhoff, Jr. 1969. A controlled deer hunt on Crab Orchard National Wildlife Refuge. J. Wildl. Manage. 33:791-795.

Salwasser, H. 1987. Greenways for Americans. Pages 119-121 in L.W. Adams and D.L. Leedy (eds.), Integrating Man and Nature in the Metropolitan Environment. Proc. National. Sym. Urban Wildl., Chevy Chase, Maryland, November 1986. 249pp.

Schauman, S., S. Penland, and M. Freeman. 1987. Public knowledge of and preferences for wildlife habitats in urban open spaces. Pages 113-118 in L.W. Adams and D.L. Leedy (eds.), Integrating Man and Nature in the Metropolitan Environment. Proc. National. Sym. Urban Wildl., Chevy Chase, Maryland, November 1986. 249pp.

Shoesmith, M.W., and W.H. Koonz. 1977. The maintenance of and urban deer herd in Winnipeg, Manitoba. Trans. North Am. Wildl. and Nat. Resour. Conf. 42:278-285.

Warner, R.A. 1986. Ticks and deer team up to cause trouble for man. Smithsonian, Apr. pp. 131-145.

Wemmer, C., and M. Stuwe. 1985. Reducing deer populations in large enclosures with drives. Wildl. Soc. Bull. 13:245-245.

Wendling, R.C., S.J. Gabriel, J.F. Dwyer, and R.L. Buck. 1981. Forest Preserve District of Cook County, Illinois. J. For. 79:602-605.

Woolf, A. 1986. Lyme disease. Outdoor Highlights. Illinois Dep. of Conserv., Springfield. 14:3-5.

Table 1. Locations of deer browsing damage on ornamental plants as reported to the Illinois Department of Conservation (Garrow, pers. commun.) and the Illinois Natural History Survey.

County	Village	Street
Cook		
	Barrington	
		Bateman Circle
		E. Lake Shore Dr.
		Lake-Cook Rd.
	Blue Island	
		Ashland/Western
	Countryside	
		67th St.
	Des Plaines	
		Busse Hwy
	Glencoe	
		Hohlfelder Rd.
		Washington Ave.
	Glenview	
		Maple St.
	Hinsdale	
		County Line Rd.
		German Church Rd.
		Madison St.
		Nielsen Ln.
	Mt. Prospect	
		Park Dr.
	Northbrook	
		Edgewood
		Grant Rd.
		Forest View Dr.
		Marshall Rd.
		Oak Knoll Terrace
		Otis Pl.
		Sanders Rd.
		Saunders Rd.
		Sunset Ct.
		Terri-Lyn Ln.
		Timberland Dr.

cont.

Table 1. (cont.)

County	Village	Street
Cook		
	Northfield	
		Meadow View Rd.
		Winnetka Ave.
	Winnetka	
		Boal Parkway
		Hackberry Ln.
		Pine St.
		Woodley Rd.
DuPage		
	Near Argonne	
		S. Cass Ave.
	Lemont	
		White Deer Dr.
	Oakbrook	
		Adams
	Wheaton	
		Winfield Rd.
Lake		
	Antioch	
		N. Crawford
		N. Eline Rd.
	Highland Park	
		Half-day Rd.
		Meadow
	Lake Forest	
		S. Ridge Rd.
	West Lake Forest	
		Oldmill Rd.
	Winthrop Harbor	
		Park Ave
		The Pines Subdivision
	Zion	
		Elizabeth St.
		Ezekiel St.

Table 2. Number of deer-vehicle accidents reported on state numbered highways in northeastern Illinois between 1978–1986 (Illinois Dep. Trans., unpubl. records).

	Year								
County	78	79	80	81	82	83	84	85	86
Cook	137	112	139	167	260	248	354	379	469
DuPage	20	19	19	20	23	31	50	58	76
Kane	24	34	36	36	55	68	80	81	124
Lake	66	50	53	73	105	126	157	200	250
Total	247	215	247	296	443	473	641	718	919

Table 3. Agencies and organizations with representatives serving on the Community Liason Committee for the INHS Urban Deer study.

American Humane Association
Brookfield Zoo
Cook County Forest Preserve District
Fund for Animals
Great Lakes Outdoor Writers
Illinois Audubon Society
Illinois Department of Conservation
Illinois Natural History Survey
Illinois Nature Preserves Commission
Illinois Wildlife Federation
Lake County Forest Preserve District
McGraw Wildlife Foundation
Morton Arboretum
O'Hare International Airport
Sierra Club
U. S. Department of Agriculture

Appendix A. North American cities and special use areas (airports, arboretums, state parks etc.) with recognized deer-human conflict(s).

Angel Island, California- 1 mile2 island in San Franciso Bay. Administered by California State Park system. Severe damage to native vegetation. Deer habituated to people. Long history of deer reduction and control of black-tailed deer (Odocoileus hemionus). Culling by marksmen stopped by San Francisco Anti-cruelty society. Live-trap and translocation > 200 deer viewed as not cost effective. Experimental use of chemosterilents unsuccessful in controlling rate of increase of herd. Currently, deer are shot by professional marksmen with carcasses donated to charities.

Boulder, Colorado- city is located in foothills on traditional mule deer (Odocoileus hemionus) winter range. Conflicts with deer-vehicle accidents and browsing damage to ornamental plantings. Active research and monitoring program on 17 mile2 area. Herd size estimated at 700-1000 deer.

Carey Arboretum, Millbrook, New York- research on deer fence and repellents. Special regulated sport hunting.

Cleveland, Ohio- limited study of deer movements on municipal park district properties. Ohio State graduate student presently on followup study.

Front Royal, Virginia- Smithsonian, National Zoo property. Controlled hunting stopped through political process initiated by animal protectionist group. Deer herd studied by graduate students. Currently, deer driven from fenced property by drives. Research proposal to study impact of deer on rodent survival.

Gettysburg National Military Park, Pennsylvania. Research on managing deer, necessary to maintain vegetation in historical and natural condition.

Ipswich, Massachusetts- Crane Memorial Reservation, 2100 ac. Research on deer management computer models, evaluation of deer impact, recommendations for herd reduction.

cont.

Appendix A. (cont.)

Madison, Wisconsin- Deer browsing and antler damage on Univ. of Wisconsin-Madison Arboretum. Graduate student studied deer removal techniques, reduced herd from 50 to about 4 deer. Subsequent live-trapping program did not offset rate of herd increase. Current herd size about 40 animals.

Milwaukee, Wisconsin- occasional deer conflicts in city handled by Milwaukee Humane Society (Nielson, pers. commun.). Schlitz Audubon Center has active deer removal program using live-traps and translocation technique. Removal integrated into naturalist program. Center is 188 acres with deer herd of < 50 animals (Nichols, pers. commun.).

Minneapolis/St. Paul, Minnesota- Hennepin County Park system supports deer control program. Some herd reduction by shooting by professional marksmen. Shotgun and archery hunting initiated in segments of park system in 1985.

Pittsburgh, Pennsylvania- Pittsburgh Airport has active deer removal program. Electric fence borders active runways.

Washington D.C.- Dulles Airport. Seven deer-aircraft collisions since 1985.

Winnipeg, Manitoba- research by Shoesmith and Koontz (1977). Graduate student making current assessment.

Appendix B. Illinois Natural History Survey Urban Deer Study research objectives.

Job No. 104-1
Biology and ecology of urban deer

Objective: To investigate and quantify pertinent aspects of life history, ecology, health, abundance, dynamics, and distribution of deer in metropolitan areas of northeastern Illinois relative and necessary to their successful management.

Job No. 104-2
Deer range evaluation for metropolitan northeastern Illinois

Objective: To measure, map, and otherwise quantify and qualify the present and potential deer range of northeastern Illinois including assessments of present impacts on vegetation.

Job No. 104-3
Management strategies and implementation of experimental control of urban deer

Objective: To design, implement, and evaluate possible alternative strategies for management of deer in urban areas with special respect to northeastern Illinois. Pilot management programs to be undertaken as cooperative programs with the Illinois Department of Conservation and local public agencies sustaining significant deer problems.

Job No. 104-4
Data base management, analysis, and reporting on urban deer research

Objective: To compile, organize, computerize, and manage for ready access, security, and preservation all data resulting from this study relating to deer, deer range, and other aspects of natural resource information generated by this project. Data to be integrated into data base.

Appendix C. Recommendations for deer removal on O'Hare International Airport.

EXECUTIVE SUMMARY

TITLE: Recommendations for deer management on O'Hare International Airport

PROBLEM

O'Hare International Airport is currently faced with a serious deer management problem. A large number of white-tailed deer (Odocoileus virginianus) live on airport property near active runways. The deer range freely and are sighted especially during spring, on or near active runways, causing imminent danger to transitional aircraft and their passengers. On 17 March 1987, a United Airlines 737 struck a subadult male deer which caused over $114,000.00 in aircraft damage. The presence of deer on O'Hare property is incompatible with airport mission safety. Previous efforts by O'Hare personnel to live-trap deer from 1983 to 1987, were insufficient to limit herd increase. More effective and sustained efforts to remove deer are warranted at this time. The goal of deer removal should be to reduce the probability of a deer-aircraft collision, and other deer-runway incidents, to an acceptable level as defined by O'Hare Airport.

DEER REMOVAL OBJECTIVES

1) To define the maximum number of deer that O'Hare will accept on airport property.

2) To select a deer management strategy that addresses both long and short term needs.

3) To provide economic, logistic, and political support needed to immediately implement deer reduction.

4) To provide regular and effective evaluation of deer numbers and to maintain those numbers at, or below, maximum numbers defined in objective #1.

5) To minimize negative publicity.

MANAGEMENT STRATEGIES

Long term deer management options should be seriously evaluated. Favorable deer habitat near runways is the primary causal factor of large deer numbers on airport property. A secondary factor may be occasional deer immigration from forest preserves east of the airport. Long term management should emphasize reduction of deer habitat, and if immigration is a factor, deer-proof barriers should be erected.

The immediate need to reduce deer numbers prior to the spring of 1988 requires implementation of an effective short term strategy. Methods used to reduce deer numbers have a seemingly inverse relationship between efficiency and public acceptance. Lethal methods, are most efficient, but have lower acceptability to the urban public than live-trapping and translocation. The choice of methodology(ies) should be weighed against the severity of the consequences of a deer-aircraft accident, and the probability of accident occurence. We recommend that deer be removed in the most expeditious manner possible. However, if there is need to offset potential negative public reaction, then live-trapping could be implemented in combination with lethal removal. Live-trapping only, may not achieve sufficient reduction in deer numbers.

AGENCY RESPONSIBILITIES

The landowner, O'Hare International Airport--City of Chicago, controls deer habitat on airport property and thus has primary economic responsibility for deer removal. Deer removal must be in accord with state wildlife regulations enforced by the

Illinois Department of Conservation (IDOC). Principal IDOC contact is Mr. Forrest Loomis, Forest Game Supervisor.

We suggest that O'Hare Airport personnel take active participation in deer removal. Chicago Animal Control should be enlisted for technical, logistical, and personnel support.

The state, through the IDOC and the Illinois Natural History Survey Urban Deer Study (INHS), will provide information, counsel, and training in deer removal methods. INHS personnel (Dr. J. Witham and Mr. J. Jones) will be available to demonstrate live-capture, handling, and transport of deer, for 2-3 days in early November 1987. A 2-3 day demonstration of lethal removal of deer by shooting over pre-baited sites, and the processing of carcasses for donation to charitable organizations, will also be available between November 1987 and January 1988.

CONTRACTUAL REMOVAL OF DEER BY IDOC/INHS

In this case, if requested by O'Hare Airport, the IDOC/INHS would be available to conduct short term reduction of deer numbers during the fall of 1987 and winter of 1988, under contract. The removals would be considered as a pilot study by the INHS Urban Deer Research Program. A draft budget for contractual removals is provided in Appendix E.

INTRODUCTION

O'Hare International Airport is currently faced with a significant deer problem. A minimum of 37 white-tailed deer (Odocoileus virginanus) were sighted in wooded/shrub habitat adjacent to active runways in March 1987. Numerous incidents of deer on, or near, runways were reported during spring 1987. An 80-lb male fawn, struck by a landing United Airlines 737 jet on 17 March 1987, caused aircraft damage in excess of $114,000.00. Fawns produced during the summer of 1987 have further increased accident potential.

Efforts by O'Hare personnel over the years 1983 - 1987 to live-trap deer have not successfully limited herd increase. A sustained and comprehensive approach to reduce and control deer numbers should be implemented as soon as possible. The primary need is to select and implement a management strategy that will effectively reduce herd size. A secondary, but real need, is to minimize or buffer negative social reaction to deer removal.

The Illinois Natural History Survey (INHS) has investigated urban deer problems and control in northeastern Illinois since 1983. In this paper we provide O'Hare Airport Authority with information with which to select and implement a comprehensive deer management program. Specific objectives of this paper are to:

- Describe habitat, herd origin, and deer behavior that contributes to airport deer problems
- Review historic and recent deer control activities
- List possible deer control methods
- Suggest goals and alternative strategies for herd reduction, carcass disposition, and media contact

- Describe state involvement in airport deer control activities

DEER HABITAT ON AIRPORT AND ADJACENT PROPERTIES

Although highways, parking lots, terminals, and runways dominate O'Hare Airport, considerable peripheral airport property has remained undeveloped. Three areas have woodlots that provide marginal to excellent cover for deer (Fig. 1).

Largest numbers of deer occur west of Runway 14R/32L and north of Runway 4R. Until 1984, the 650-ha site was a diverse mixture of old fields and swamp/marsh interspersed among relatively small patches of open canopy hardwoods. A tree nursery maintained for the Chicago Park District is located on the north end of this area. Between 1984 and 1986, about 250 ha of this area (Fig. 1; Area 1B) was developed for air cargo facilities. Construction activities and loss of habitat undoubtably caused deer to concentrate north of St. John's Cemetery (Fig. 1; Area 1B).

Relatively few deer have been observed on the other 2 areas. One is a sparsely wooded 70-ha site in the northwest corner of O`Hare property immediately northwest of the airline maintenance building complex (Fig. 1; Area 2). The second is a 180-ha woodlot/shrub/old field north of Runways 14L and 22R (Fig. 1; Area 3). A second Chicago Park District tree nursery is located in the latter area.

Aerial photographs of O'Hare and adjacent properties were reviewed for 1949, 1963, 1975, and 1985. The sequence of photographs shows successional changes in vegetation that have

increased quality and quantity of deer habitat on peripheral airport property (Fig. 2). The agriculture influenced landscape of 1949 had by 1985 evolved into a more structurally diverse mixture of vegetative types which has favored establishment and increase of deer.

Conversely, during the same period, most private property immediately north, west, and south of O'Hare was developed for residential, commercial, and industrial land uses. However, east of the airport, separated by a 1.3 to 2.0 km strip of commercial development, are county forest preserves which sustain sizable numbers of deer (Fig. 3).

DEER HERD ORIGIN AND MOVEMENTS

The origin of the O'Hare deer herd is speculative. It is likely that deer from Des Plaines River forests formed the nucleus of the O'Hare deer herd. Subsequent intensive development of private properties adjacent to O'Hare has formed partial barriers to deer ingress and egress. Deer immigration, possible 40 years ago, seems unlikely today. Commerical development and highways on O'Hare's eastern boundary now form at least a partial, if not formidable, barrier to dispersing deer. We believe some immigration from the Cook County Forest Preserves (CCFPD) is possible, but infrequent. However, dispersal may be more common during years with heavy floods or deep snowfall.

Seasonality of deer incidents on O'Hare during March to early June may be influenced by foraging and pre-partum behavior. In spring deer tend to forage in open areas away from woodlots (i.e., first sites to "green up" are mowed areas near runways).

Also, during late spring, pregnant females become aggressive toward former offspring, and this behavior promotes wandering and dispersal among these subadults. Deer are most frequently observed near runways during spring. Two deer-aircraft collisions have occurred in March (1982 and 1987).

MANAGEMENT OF DEER ON O'HARE AIRPORT

Historic deer management activities

Deer management at O'Hare prior to 1980 was poorly documented. Some illegal shooting of deer occurred between the 1960's and early 1980's. The airport perimeter fence had periodically been cut and deer entrails were occasionally found. Local residents and O'Hare employees may have performed illegal "deer control" during this period.

First official reduction of deer numbers was precipitated by a deer-jet collision (American Airlines DC-10) on 31 March 1982 (Iker 1983). Following this accident, the U. S. Fish and Wildlife Service (USFWS), IDOC, and O'Hare coordinated a series of deer drives during April-May 1982 in which a minimum of 14 deer were shot by IDOC and USFWS personnel (Garrow, IDOC, unpub. notes). The drives were discontinued because few deer were being taken, deer had become extremely wary, and because of the increased potential for deer being driven onto runways. Officials chose not to implement a USFWS recommendation to construct a 12-foot high deer-proof fence on the east and northeast perimeters of O'Hare.

Options for deer removal were reviewed by Federal Aviation Administration, IDOC, O'Hare, and USFWS personnel on 20 January

1983 (Appendix A). Capture, handling, and transport methodologies were discussed with an IDOC recommendation to live capture deer with box traps being implemented (Appendix B). Two deer were captured and transported to the Des Plaines Conservation area during the winter of 1983, one which died of capture related injuries (Gebhardt, O'Hare, pers. commun.; Garrow, IDOC, unpub. notes). O'Hare personnel continued to live-trap deer from 1984 through 1987. No records were kept of any deer trapped, although no deer were captured during the winters of 1985-86 and 1986-87. A retrospective estimate of total deer live-captured between 1983 and 1987 was 5 (Gebhart, O'Hare, pers. commun.).

The most recent deer drives were in spring 1983 and 1984. Five deer were shot by IDOC and USFWS employees on 5 May 1983. Drives by IDOC and USFWS personnel on 8-9 May 1984 were unsuccessful. INHS records of deer killed on those drives may be incomplete. IDOC personnel have stated that a total of 22-23 deer were shot during drives-- 4-5 more deer than INHS has documented. If IDOC personnel are correct, the 4-5 deer were shot on drives prior to 5 May 1983.

The INHS Urban Deer Study was initiated in July 1983. The research is sponsored from funds administered by the IDOC (Pittman Robertson, F.A. Project W-87-R). The INHS research program has functioned as an on-site liason between IDOC and O'Hare Airport since 1984.

In 1984, INHS and O'Hare discussed using the airport as a site for research on herd reduction, but the idea was not acted on. However, O'Hare and INHS jointly counted deer by helicopter

(Chicago Fire Department Bell Jet Ranger) during the winters of 1984, 1985, and 1986 (Appendix C). O'Hare personnel counted 5 deer during a fall 1986 flight (Gebhardt, O'Hare, pers. commun.). O'Hare officials were not able to obtain a city helicopter from which to count deer during the winter of 1987.

Recent deer management activities

Deer were sighted repeatedly near, and on, active runways during early spring in 1987. On 17 March, a United 737 airliner struck and killed an 80-lb subadult male deer on Runway 14R that caused repair damage in excess of $100,000.00. INHS counted 43 deer (43 deer observed; 6 possible duplicate sightings) on a 31 March helicopter (Il. Dep. Trans. Bell Long Ranger) census (Appendix D).

Deer control needs were discussed by O'Hare, INHS, and Chicago Animal Control (CAC) personnel on 30 April 1987. There was agreement that an attempt should be made to reduce deer numbers prior to fawning in June.

Chicago Animal Control attempted to tranquilize deer by remote chemical injection during a 2-week-period in May. Five deer were darted, but none was successfully live-captured. Heavy vegetation precluded tracking of deer that ran out of view before tranquilizer induction. These efforts were discontinued and reviewed on 15 May. Chicago Animal Control indicated that tranquilizing deer by remote chemical injection was not effective under extant conditions. Recommendations by CAC were to cut grass adjacent to runways and to build a corral trap.

Grass near runways was cut by O'Hare maintenance personnel.

O'Hare and CAC personnel constructed a corral trap from 6 INHS drive nets. Although deer sign was observed near the trap gate, no deer were captured and the trap was dismantled in July.

TECHNIQUES TO REDUCE DEER CONFLICTS

In reviewing methods used to exclude deer, or reduce deer herd size, it is important not to become "lost" in a search for the ideal technique that will painlessly solve all problems. There is no such panacea. Depending on the circumstances, some removal techniques are more efficient than others. However, no single method will operate ideally under all conditions. Success will be largely determined by the skill and commitment of individuals that support and implement control programs. The following review was adapted from Rongstad and McCabe (1984) and Matschke et al. (1984).

Habitat manipulation: Presence of a resident deer herd on O'Hare property is possible only because suitable habitat exists. Quality of deer habitat has become more favorable over the last 36 years. A program to eradicate deer habitat, particularly shrubs and trees that provide cover, would eliminate deer herds from O'Hare. An on-site example of this approach was construction and development of the air cargo facility, which reduced primary deer habitat on O'Hare by 28%.

Exclusion/barriers: Deer movements and/or access to favorable habitat could be reduced by strategic placement of barriers. No fence is completely reliable, however, properly maintained fences will exclude most deer. Deer-proof fences are based on 2 principles: height and adversive conditioning.

Vertical woven wire fences-- Minimum of 8' high, smooth wire strands stretched above fence extend effective height, deer may gain access through breaks in the fence or by gaps beneath fence.

Electric fence-- Based on adversive conditioning, electric shock induces future avoidance, most effective technique employs 5-6 strands of high tensile smooth wire with "New

Zealand style" high-output fence charger

Live capture: Most effective with naive deer or when deer are nutritionally stressed during winter. Deer baited into trap sites. Becomes less effective over time and as density decreases. Deer can be translocated or euthanized. Labor intensive.

Remote chemical injection-- Requires close proximity (20-25 m maximum) and ability to relocate deer that travel distances during interim between chemical injection and induction.

Box and net capture methods:

Box traps-- Numerous styles, portable, generally produce single captures, can be left unattended and checked daily, O'Hare has operated 3 Stephenson style box traps since 1983.

Corral traps-- Stationary enclosures with net or wood walls, multiple captures, gate closed manually or by trip-wire, deer in trap must be "recaptured" either by remote chemical injection or physical restraint.

Drive net-- Tangle net, does not require bait, deer driven into net by helicopter or drive line, only first few animals are captured, used during any season, requires large crew, INHS has six 100' drive nets, INHS had poor success with drive nets in northwest Cook County.

Drop net-- Suspended above bait site, blasting cap discharged to drop net onto deer, requires large crew, potential for capturing large number of deer, preferred deer capture technique in Colorado, Arizona, Texas, and some other states.

Rocket net-- Prebaited site, rockets discharged from remote postion, rockets pull net over deer, requires large crew, used by INHS to capture over 200 deer, captures 1-6 deer per discharge.

Lethal removal: A collection of methods that cause deer mortality. More efficient than live capture, particularly when herd density is low.

Bait shooting-- Prebaited site, elevated blind, controlled, shotgun or rifle, minimum personnel, used by INHS in northwest Cook County.

Deer drive shooting-- Unarmed drivers form line and push deer out of cover toward shooters, requires large crew, most effective when deer density is high, IDOC shot 22-23 deer on O'Hare property in 1982-83 with this method.

Spot light shooting-- "Jack light," lights used to located

deer near roads at night, deer shot from vehicle, horizontal bullet trajectory is potentially dangerous, used by INHS in northwest Cook County.

Archery or crossbow-- Used at bait site or near active trail, less efficient that rifle or shotgun, higher wounding losses, discrete, no audible discharge.

CARCASS AND ANIMAL DISPOSITION

A secondary consideration in deer removal is disposition of the animals or carcasses. The public has substantial interest in disposition of deer once they are captured or killed. It is prudent to select disposal options that provide optimal use. Methods of carcass disposal must be listed on the IDOC Nuisance Deer Removal Permits.

Translocate live deer-- Requires humane and safe handling of deer. Some mortality must be expected during handling and transport. Labor intensive. Permission must be received from landowner and IDOC to release deer. Favored by public.

Live capture and euthanize-- Deer are killed once they are captured in nets or traps. Deer meat cannot be given to charities or for animal consumption if euthanized with chemicals.

Human consumption-- Carcasses of properly butchered deer can be donated to charitable organizations as specified by the IDOC. Currently, carcass must be processed by a state licensed meat packing facility. Processing cost per field dressed carcass is about $50.00. Packaged venison donated to Chicago Food Depository for distribution to the indigent of Chicago.

Animal consumption-- Large zoos will not take deer carcasses because of potential for disease transmission. Many smaller zoo's and animal rehabilition centers will accept venison to feed captive raptors and other carnivores.

Scientific uses-- Samples and measurements can be collected from deer carcasses to determine condition, productivity, and other useful data. Most data can be collected without sacrificing quality of carcass for human or animal consumption. Samples needed are small and the bulk of the carcass must still be disposed of, however.

Bury-- Efficient. Wasteful. Low acceptability.

Cremate-- Efficient. Wasteful. Low acceptability.

RECOMMENDATIONS FOR DEER HERD REDUCTION AND CONTROL

The presence of deer near active airport runways is a serious problem that needs to be addressed immediately. Herd size is unknown, although, a minimum of 37 deer was counted in March 1987, prior to parturition. Fawns produced last summer should elevate herd size in fall 1987 to a minimum of 50-60 deer. It is essential that most, if not all, of these deer be removed prior to emergence of spring vegetation in March 1988. Removal will be more efficient if the winter is severe. O'Hare and Chicago Animal Control should recognize that deer removal, of the magnitude needed to significantly reduce a herd of the size on O'Hare, will require a major commitment on the part of both organizations. Only O'Hare and CAC officials can identify their own priorities. However, it should be noted that:

- Human safety is the primary concern
- Actions should effectively reduce potential for deer-aircraft incidents
- Actions should not increase probability of secondary hazards to human safety
- Actions should minimize adverse public controversy, although possible adverse public reaction does not preclude use of efficient methods

Problem statement:

The mission of O'Hare International Airport is to provide safe and efficient air transportation facilities and services. Undeveloped airport property near active runways provide habitat that supports relatively large numbers of white-tailed deer. These deer range freely and are observed near active runways causing immediate danger to transitional aircraft. Presence of deer on O'Hare property is

incompatible with airport mission safety. Live trapping by O'Hare over 4 years has been ineffective. More effective methods of control are warranted.

Program goal:

To reduce probability of deer-aircraft collisions and other deer-runway incidents to an acceptable level as defined by the O'Hare International Airport Authority.

Objectives:

- To define the maximum number of deer that O'Hare/CAC will accept on airport property. (The maximum number will be used as a decision rule above which reduction will be implemented).
- To select a deer management strategy from long and short term options that recognizes the need for periodic, perhaps annual control efforts.
- To provide the economic, logistic, and political support needed to implement deer management during autumn 1987.
- To reduce deer numbers to a level below the defined decision rule number before 1 April 1988.
- To provide regular and effective evaluations of deer numbers, and to maintain numbers at or below the specified decision rule indefinitely.
- To minimize negative publicity and intra-agency controversy.

Decision rule

Selection of a critical abundance number (decision rule) provides a direct statement of commitment to herd reduction and subsequent control. There are 4 general levels of deer abundance to consider. Subjectively chosen herd sizes are listed for purpose of establishing a specific decision rule level for O'Hare Airport that can be directly related to removals needed for reducing the estimated 50-60 animals now present.

- **No maximum population level**

  Decision rule not to remove deer

  No effort, or, token effort

- **Moderate to high residual population**

  Decision rule- remove all deer in excess of 20 animals

  Effort--to remove a limited number of deer and stop when efficiency begins to decline

- **Low residual population**

  Decision rule- remove deer in excess of 10 animals

  Effort--to remove maximum number of deer with acceptance that a limited number cannot be removed without excessive effort and the reality of occasional immigrations

- **No residual population**

  Decision rule- remove all deer

  Effort- to remove maximum number of deer until no deer remain

Long term options

As a long term option, we believe that O'Hare Airport Authority should seriously consider major reduction and even elimination of deer habitat from their peripheral properties. Quality of deer habitat near active runways has improved for over 35 years. From the standpoint of reduction of deer incidents near runways, it would be desirable to reverse the process of vegetation development through habitat manipulations, or indirectly through construction. A second long term option involves the erection of barriers (i.e., deer-proof fence) to exclude deer from runways, reduce immigration from nearby forest preserves, and isolate favorable deer habitat. Both options should significantly decrease frequency of deer-runway conflicts. However, neither method will address the immediate need to reduce

deer numbers by 1 April 1988. Therefore, a short-term deer removal option should be scheduled for implementation during fall and winter of 1987-1988.

It also should be recognized that long term options may never be implemented. Both suggested long term options are expensive, require continual maintenance, and each involves ramifications that extend beyond the immediate deer problem. At minimum, a commitment should be made to develop and maintain an effective short term strategy--with full understanding that short term strategies are temporal actions that require long term attention.

Short term strategies

Among deer removal techniques, a seemingly inverse relationship exists between efficiency and public acceptability. The most efficient methods--lethal removals--are less acceptable to the public than live capture. Conversely, live capture techniques are more acceptable but much less efficient. To help visualize these relationships we have ranked removal methods by efficiency (Fig. 4) and public acceptance (Fig. 5). Efficiency relationships are assessments of the ability of INHS/IDOC personnel to implement these techniques under site specific conditions that exist on O'Hare Airport. These assessments are based on extensive local research elsewhere in the Chicago metropolitan area.

A strategy for animal or carcass disposition should also be considered (Fig. 6). The public is interested not only in how an animal is removed, but what happens to the animal or carcass subsequent to removal. There is a major difference between

translocation of live deer and carcass utilization, with the former much favored over the latter. However, when carcasses are obtained, it is desirable to ensure their optimal use. Human consumption--specifically donation of processed venison to charitable organizations that feed the indigent--helps buffer negative public responses to lethal removals. Scientific uses, (tissue samples, physical measurements, reproductive tract examininations, condition evaluations etc.) can provide valuable data and should be viewed as a asset that can help optimize carcass usage and thus help rationalize lethal removal.

List of strategies

I. Do nothing. Accept consequences of high deer numbers

II. Long term options

A. **Habitat manipulation**-- Costly to effect and maintain but possible to accomplish. Would require additional evaluation beyond scope of this paper. INHS and IDOC would provide evaluation if O'Hare expressed serious interest in this long term option.

B. **Exclusion barriers**-- Also, costly to effect and would require annual maintenance but possible to accomplish. Would require additional evaluation beyond scope of this paper. INHS and IDOC would provide evaluation if O'Hare demonstrated serious interest in this method of control.

III. Short term options

A. **Maximum efficiency**-- Achieved by selection of techniques high on Fig. 6. The most efficient removal technique is shooting over bait. Most efficient disposal would be to bury or cremate carcasses. Consequence of maximum efficiency is potentially greater public opposition and vulnerability if controversy occurs. Must be accomplished with relative discretion.

FALL- SHOOT OVER BAIT SITES (BURY CARCASSES)
WINTER- SHOOT OVER BAIT SITES (BURY CARCASSES)

B. **Maximum positive public image**-- Achieved through live trapping and translocation. As some deer are removed, and numbers are reduced, efficiency will substantially

decrease. Live trapping requires a high manpower commitment and expertise in handling and transport. Many deer will not be trapped leaving a substantial residual herd.

FALL- LIVE TRAP (TRANSPORT AND RELEASE)
WINTER- LIVE TRAP (TRANSPORT AND RELEASE)

C. **Balanced strategy**-- Achieved by a combination of techniques. Emphasize advantages of each method to offset or buffer negative consequences.

Attempts at reduction during fall should be made with lower efficiency method. The greatest number of deer will be available in fall and will include naive animals that are susceptible to live trapping. Deer are in peak condition during fall, which will reduce handling and transport mortalities. The primary value of trapping may be public relations.

Secondary reduction follows at start of winter with more efficient lethal techniques to remove wary deer and achieve a lower density. Maximize use of carcasses by having meat processed for human and animal consumption; collect data for scientific or management purposes. Animals in poor physical condition should be buried and cremated.

FALL- LIVE TRAP (TRANSPORT AND RELEASE)
WINTER- SHOOT OVER BAIT SITES (DONATE MEAT TO CHARITY; ZOO ANIMAL CONSUMPTION; SCIENTIFIC USES)

Program evaluation

Regular counts of deer from a helicopter are essential for evaluation of herd size. Flights should be conducted between November-March when deciduous plants are defoliated, preferably when the ground is snow covered. Minimum snow depth of 4-6 inches provides excellent contrast for visibility. However, on areas of limited size, such as O'Hare, deer can be counted fairly accurately without snow cover by flying at heights just above tree level. Pilots experienced with O'Hare tower communications are absolutely essential. Only experienced observers should be used and experienced pilots are desirable.

Suggestions for media contact

Deer removal is potentially controversial and organizations should carefully formulate strategies for working with media and public. The first reaction to potential controversy is to avoid contact with media with hope that actions will not become issues. This practice is standard and there is substantial wisdom in this approach. However, an agency is immediately placed in a reactive or a compromised position if actions are independently "discovered" because circumstances are perceived as being "covered up". It would be naive to assume that deer removal can take place on O'Hare without some accidental release of information. To reduce this possibility, we believe that a low key statement should be released to the press well in advance of deer removals. The statement should acknowledge that:

- The resident deer herd has increased in size because of 2 consecutive mild winters.
- "Incidents" involving deer and aircraft have occurred.
- There is concern for human saftey and action is required.
- Options are being evaluated in consultation with city and state wildlife agencies.
- Live trapping and translocation will be initiated during the fall.

Furthermore, we suggest that a news release be written before final decisions on specific techniques or dates of implementation, and that:

- Specific reporters be targeted and provided with advance copy.
- A single person should be selected to answer all questions from the media. That person must be well informed on the problem, on deer, and on the control program.

- All involved parties should refer questions to the designated spokesperson.

- A file should be maintained that includes press releases, written documentation of all contacts with media, and copies of resultant articles, as well as all pertinent data and program related information.

- A post-activity summary be prepared, filed, and distributed only if specific requests are received.

Role of state agencies in urban deer management

The landowner controls the habitat and thus has primary responsibility for deer damage abatement. The role of the state is to facilitate the needs of the landowner by providing information, counsel, and training in deer removal methods and damage abatement. If direct reduction is an option approved by the state, but cannot be performed by the landowner, the state may choose to implement herd reduction under contract from the landowner.

To this end, the state has offered the following services to O'Hare International Airport through the IDOC sponsored INHS Urban Deer Study:

- **Information and consultation**

  Mr. Forrest Loomis
  Il. Dep. of Conservation
  (309) 374-2492

  Dr. James H. Witham
  Il. Natural History Survey
  (312) 289-7620

- **IDOC Nuisance Deer removal permit** (Loomis, IDOC)

- **Written management recommendations** (Witham, INHS)

- **Training O'Hare/CAC personnel** (Witham, INHS)

  a) Live trapping/handling/transport
  (2-3 days early November 87; Witham, INHS)

  b) Bait shooting/carcass preparation
  (2-3 days early January 1988; Witham, INHS)

- **Provide cost estimate for state personnel to perform herd reduction** (Witham, INHS; Appendix E).

LITERATURE CITED

Iker, S. 1983. Swamped with deer. National Wildlife, Oct.-Nov:4-11.

Matschke, G.H., D.S. deCalesta, and J.D. Harder. 1984. Crop damage and control. Pages 647-654 in L.K. Halls (ed.) White-tailed deer, ecology and management. Stackpole Books, Harrisburg, Pa. 870pp.

Rongstad, O.J., and R.A. McCabe. 1984. Capture techniques. Pages 655-676 in L.K. Halls (ed.) White-tailed deer, ecology and management. Stackpole Books, Harrisburg, Pa. 870pp.

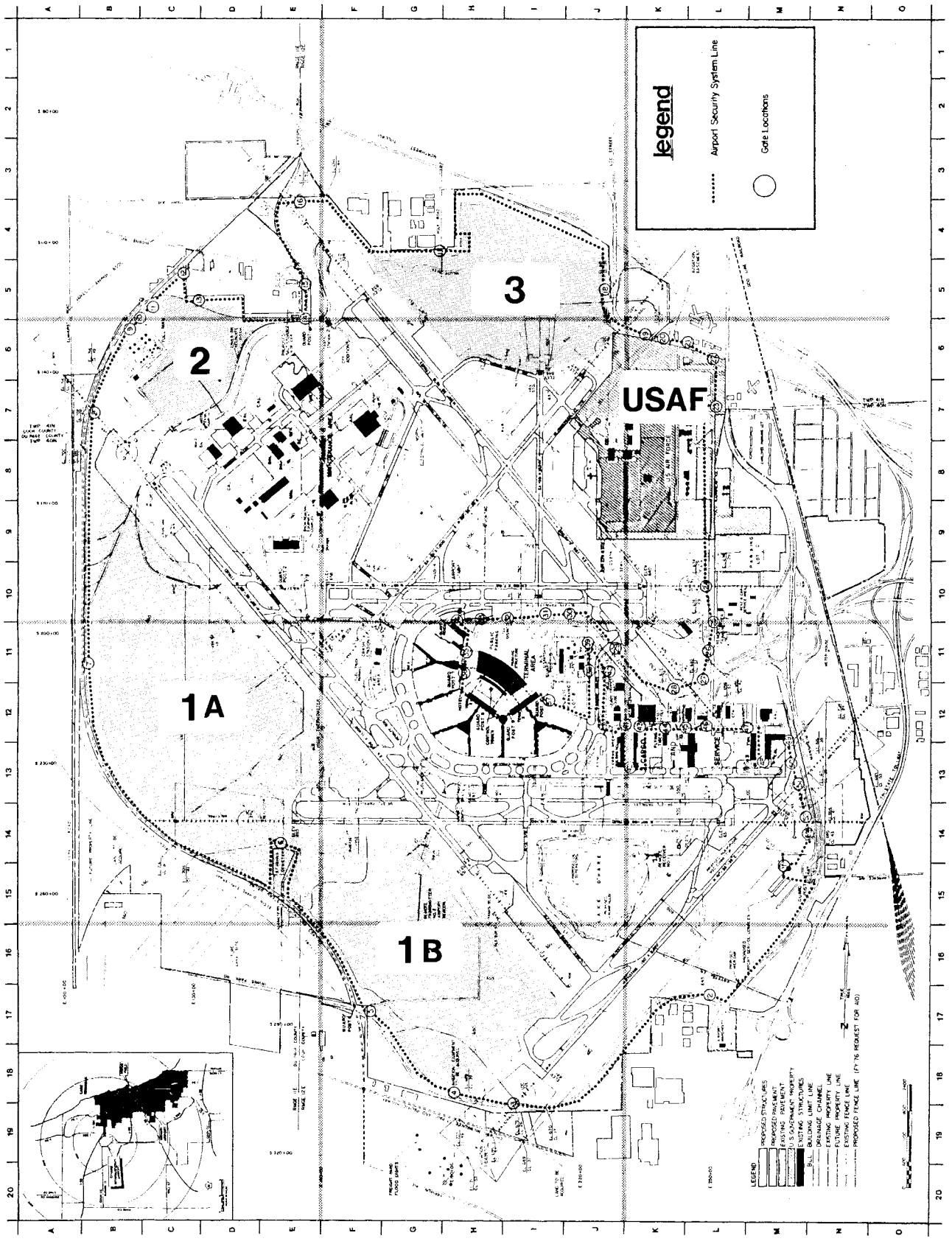
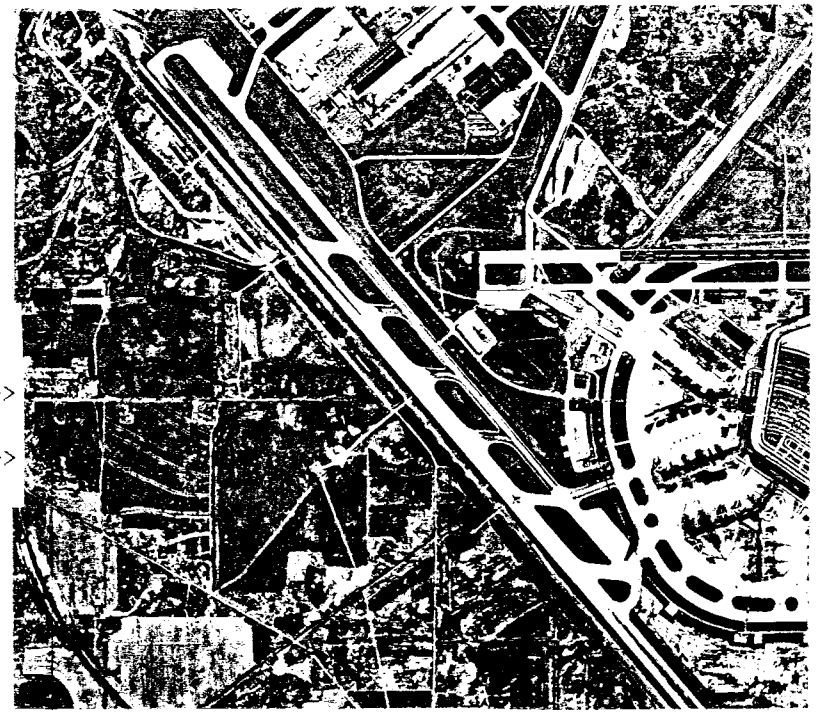


Fig. 1. Locations of deer habitat on O'Hare International Airport (shaded and labeled 1A, 1B, 2, and 3). Habitat on Area 1B was removed by construction of air cargo facility. Deer are concentrated on Area 1A.

Aerial photograph of Area 1A in 1949. Patterns of agriculture dominated landscape are evident. ------->



Chicago Parks tree nursery ------->

Aerial photograph of Area 1B in 1985. Landscape pattern shows heterogeneous vegetation. ------->

Fig. 2. Comparison of vegetation patterns near O'Hare runway 14R for 1949 and 1985. Increase in mixed vegetation in 1985 is an indication of improved deer habitat.

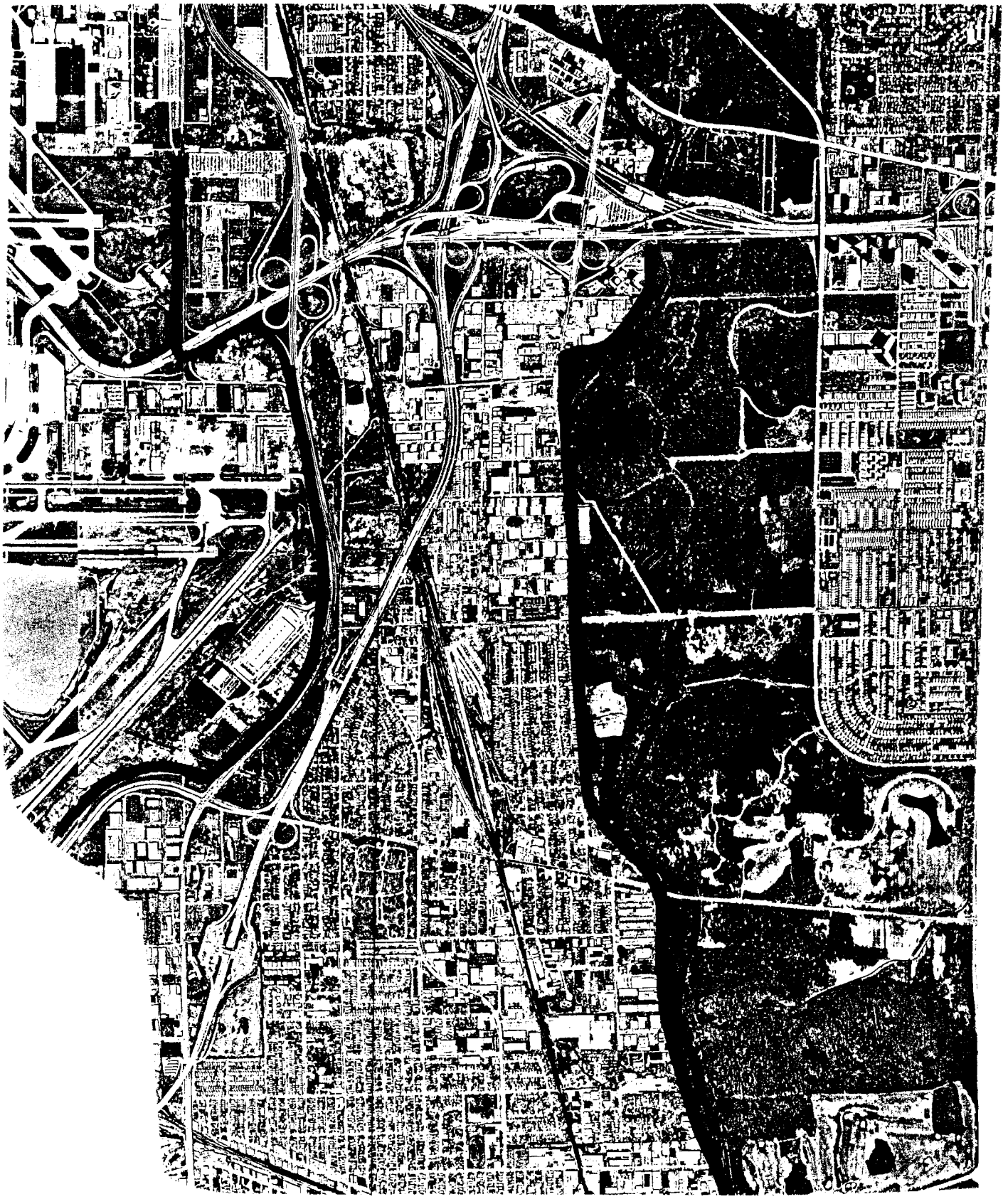


Fig. 3. Aerial photograph of eastern boundary of O'Hare Airport taken in 1985 (runways visible in upper left corner). A 1.3-2.0 km strip of commerical development separates O'Hare from county forest preserves.

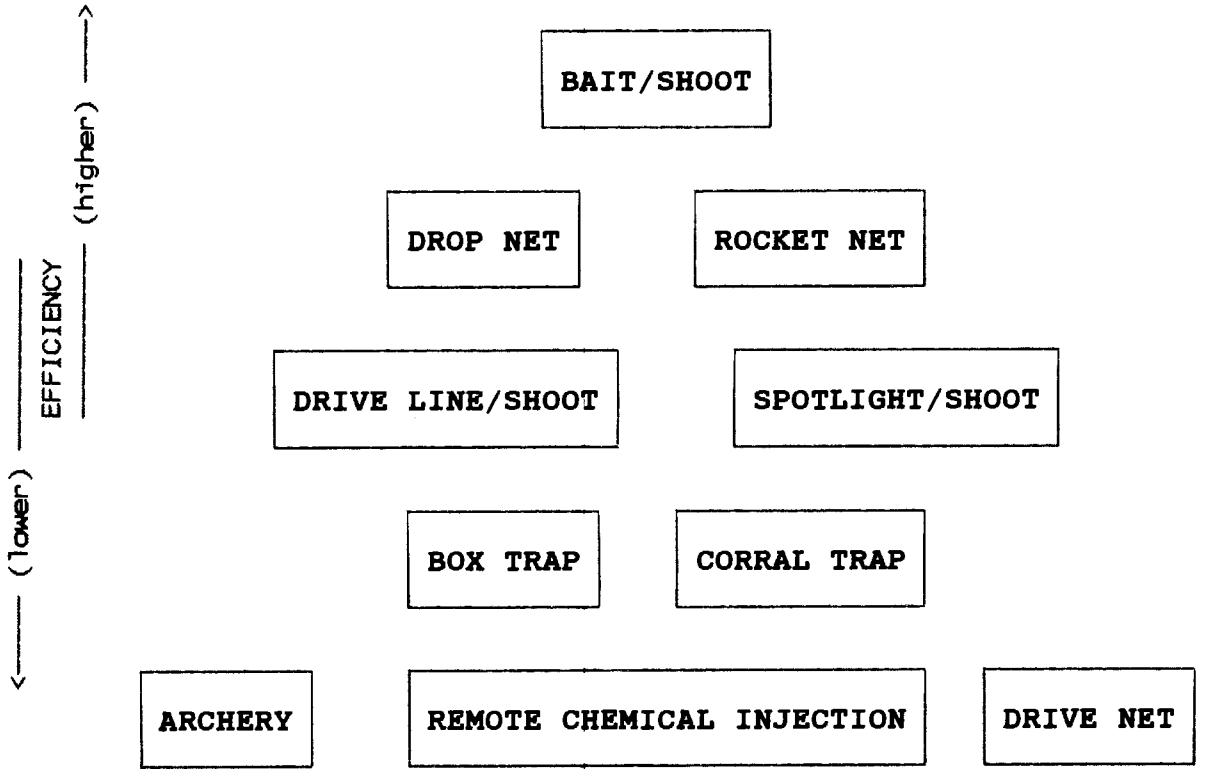


Fig. 4. Deer removal techniques ranked by efficiency. Specific level based on subjective assessment by ability of INHS/IDOC personnel to implement these techniques on O'Hare International Airport.

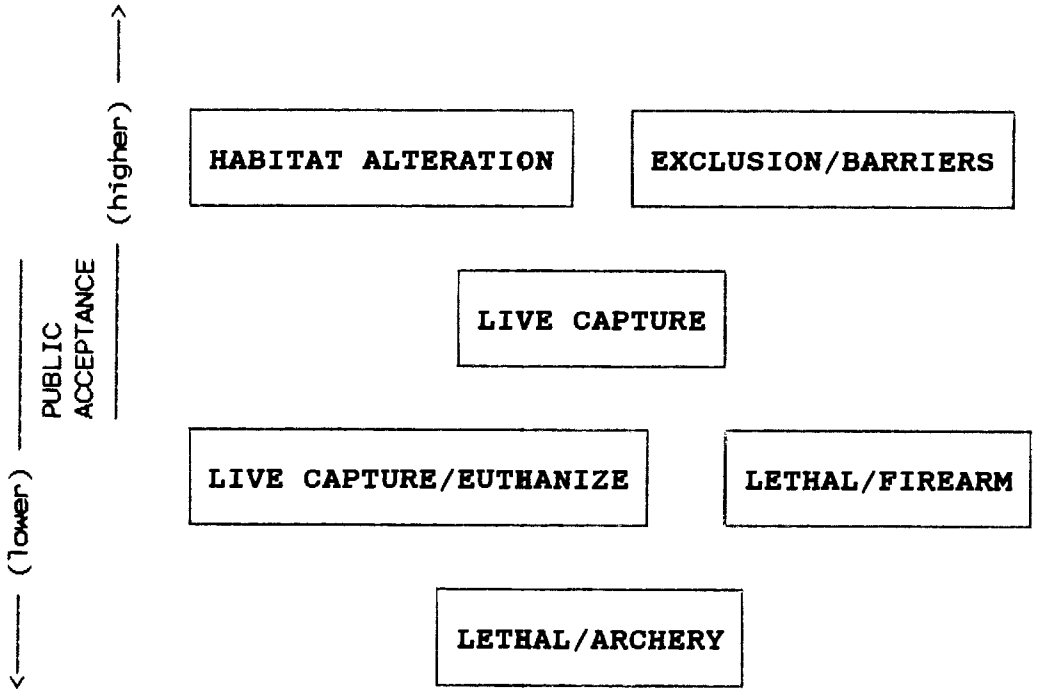


Fig. 5. Deer removal ranked by public acceptance. Specific level based on subjective assessment made by INHS personnel.

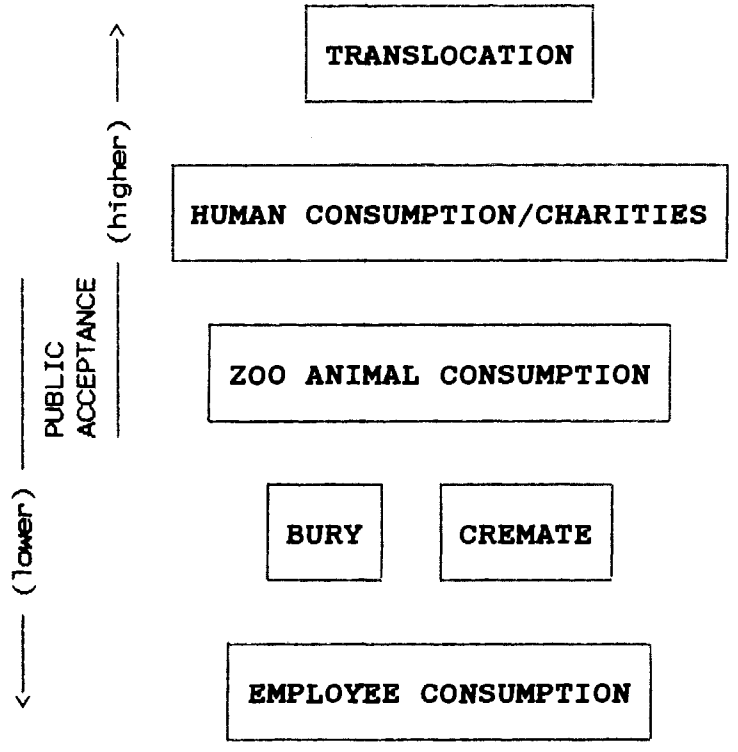


Fig. 6. Methods of disposition of deer or carcasses ranked by public acceptance. Specific level based on subjective assessment made by INHS personnel.

Appendix A. List of personnel that attended O'Hare Airport deer removal meeting on 20 January 1983.

DEPARTMENT OF AVIATION

MEETING ROSTER

SUBJECT: Wildlife Containment O'Hare

DATE: 9AM JAN 20, 1983

TIME:

NAME	TITLE	AFFILIATION/PHONE #
William T. Corbett	Deputy Commissioner	Department of Aviation 686-2697
Jane Murphy	Coordinator of Procedures	Dept. of Aviation 686-2661
Forrest Loomis, Supervisor	Forest Wildlife Program	Ill. Dept. of Conservation
Charles A Quick	Airport Certification Safety Insp.	FAA-
Ronald D. Ogden	Sr. Wildlife Biologist Assistant Wildlife Manager	U.S. Fish & Wildlife Service
Raymond W. Marshall	District Wildlife Manager	IL Dept. of Conservation
James R. Langbein	Regional Fish & Wildlife Biologist	Ill. Dept. of Conservation
Richard D. Winters	Regional State Botanist	US Fish & Wildlife Service
Scott P. Garrow	District Wildlife Manager	Ill. Dept. of Conservation
Russell R. Hebbeler	Aviation Safety Director	City of Chgo - Dept. of Aviation -
Peter Coppola	General Manager OPS	Dept. of Aviation
Paul McGraw	Ass't Chief Supervisor	Dept. Aviation

Appendix B. Illinois Department of Conservation recommendations for live-trapping deer on O'Hare Airport, 9 March 1983.

Illinois Department of Conservation
life and land together

605 WM. G. STRATTON BUILDING • 400 SOUTH SPRING STREET • SPRINGFIELD 62706
CHICAGO OFFICE – ROOM 100, 160 NO. LASALLE 60601
David Kenney, Director • James C. Helfrich, Assistant Director

RECEIVED MAR 14 1983

March 9, 1983

Mr. William Corbett
Deputy Commissioner
O'Hare International Airport
P.O. Box 66142
Chicago, Illinois 60666

Dear Mr. Corbett:

As a result of our meeting in early February regarding problem white-tailed deer on O'Hare Airport, shown below are the steps taken, and needed information enabling you to trap and transport deer from the airport to the Des Plaines Conservation Area, Will County:

1. Aerial survey was conducted on the 7,000 acre airport, and deer were located.

2. Bait, in the form of shelled corn and salt blocks, was placed in selected areas to keep deer off of runways and to get them using an area where traps will eventually be placed.

3. Plans for deer traps were explained, construction was explained to carpenters. Catching nets were ordered.

4. Finished traps were placed over bait sites which deer were using. Catching nets were delivered.

5. Set traps, capture deer, and transport them to Des Plaines Area. Contact either Ray Marshalla or Jim Langbein prior to transporting and releasing deer. Their addresses are as follows:

Ray Marshalla
Wildlife Manager
Des Plaines Conservation Area
R.R. 3, Box 167
Wilmington, IL 60481
815/476-7622 Office
815/744-2265 Home

Jim Langbein
Fish and Wildlife Supervisor
Silver Springs State Park
R.R. 1, Box 318
Yorkville, IL 60560
312/553-0859 Office
815/675-5546 Home

If you have any problems, just contact me either at home or at my office in Monmouth.

6. Upon trapping a deer, an injection of 1/4 cc to 1/2 cc of Rompon, a tranquilizer, will be administered to the hip of the deer. A blindfold should also be utilized while transporting deer.

This pretty well covers the process of moving unwanted deer. If you have any fatalities, I recommend disposing of the animals through a rendering plant, since these animals have been injected with Rompon. I doubt that they will be edible. If death occurs prior to injection, the cause of death will determine whether the animal may be utilized for food. In any rate, contact either myself or one of the biologists for further instruction.

If you have any questions on any of the above, please feel free to contact me at any time. Thank you for your cooperation in this important matter.

Sincerely,

Forrest D. Loomis

Forrest D. Loomis, Manager
Forest Wildlife Program

cc: Tranquilli
Miller
Kube
Langbein
Marshalla
Gebhardt
Coppola
Closson
Paladino
Garrow

Appendix C. Aerial counts of deer on airport property made by the Illinois Natural History Survey and O'Hare during winters of 1984, 1985, and 1986.

M E M O R A N D U M

TO Forest Loomis, Illinois Dep. of Conservation (IDOC)
Russell Gebhardt, O'Hare Airport (OHARE)
Glen Sanderson, Illinois Natural History Survey (INHS)

FROM: Jim Witham, INHS

DATE: 9 Mar 1984

SUBJECT: O'Hare Deer Survey

SUMMARY:

Search Time

Start- 1020 Finish- 1049 Total- 29 minutes

Aircraft Bell Jet Ranger, Chicago Fire Dep (CFD)

Observers Pilot (CFD)
Navigator (CFD)
J. Witham (INHS)
Rocky (OHARE)

Conditions 1-3" snow depth, drifted, some bare ground

Counts

Location	No. Deer	Other wildlife
W/SW of runways 14R/32L	8	1 red fox
NW of runways 14R/14L	0	1 cottontail
E of runway 14L, N of 18	1	1 gray fox
Runway 14L		1 red-tailed hawk
Totals	9	4

NARRATIVE:

The O'Hare Dep. of Aviation, in cooperation with the INHS, conducted a 29 min helicopter flight to count deer on O'Hare property, 9 March 1984. Light snowfall (1-3") fell on 8 March. Snow condition for visibility was marginal to adequate. Three deer groups (3, 5, 1) were counted totaling 9 individuals. The locations of deer on 8-9 March, indicated by observations, tracks and beds, were centered near coordinates IJK/1 (Chicago O'Hare International Airport, Official coordinate map, Dep. of Aviation, 1978). Notably, tracks/beds were heaviest in wooded areas adjacent to nursery stock plantings. One deer was observed in a wooded area east of runway 14L and N of runway 18. Nine deer is a minimum count. There is a high probability that some deer were not counted, although the total number of deer on O'Hare probably does not greatly exceed the minimum count.

M E M O R A N D U M

TO: Mr. Forrest Loomis, Illinois Dep. of Conservation (IDOC)
Mr. Russell Gebhardt, O'Hare Airport (OHARE)
Dr. Glen Sanderson, Illinois Natural History Survey (INHS)

FROM: Dr. Jim Witham, INHS Urban Deer Study

DATE: 7 January 1985

SUBJECT: O'Hare Deer Survey

SUMMARY

Search Time
Start- 1048 Finish- 1115 Total- 27 minutes

Aircraft Bell Jet Ranger, Chicago Fire Dep (CFD)

Observers Pilot (CFD)
Navigator (CFD)
J. Witham (INHS)
Rocky (OHARE)

Conditions about 6" snow depth, some melting and drifting,
(7-8" snow deposited during 1 Jan 85 storm)

Counts

Location	No. Deer	Other wildlife
W/SW of runways 14R/32L	8	fox den near cemetery
NW of runways 14R/14L	0	1 red-tailed hawk
E of runway 14L, N of 18	0	0
Runway 14L	0	0
Totals	8	

Narrative

The INHS/OHARE conducted a 27 min helicopter flight to count deer on O'Hare property, 7 January 1985. Substantial snowfall, 7-8", fell during a 1 January 1985 storm. Snow condition for visibility was good-very good. Three deer groups (4, 1, 3) were counted totaling 8 individuals. The locations of deer on 7 January 1985, indicated by observations, tracks and beds, were centered near coordinates IJK/1 (Chicago O'Hare International Airport, Official coordinate map, Dep. of Aviation, 1978). The location and total number of deer observed during this survey were similar to observations made on the previous, 9 March 1985, INHS/OHARE helicopter survey.

M E M O R A N D U M

TO: Mr Forrest Loomis, Illinois Dep. of Conservation (IDOC)
Mr. Russell Gebhardt, O'Hare Airport (OHARE)
Dr. Glen Sanderson, Illinois Natural History Survey (INHS)

FROM: Dr. Jim Witham, INHS Urban Deer Study

DATE: 22 Jan 86

SUBJECT: O'Hare Deer Survey- 15 January 1986

SUMMARY

Search Time
Start- 1013 Finish- 1055 Total- 42 minutes

Aircraft: Bell Jet Ranger, Chicago Fire Dep. (CFD)

Observers: Pilot (CFD)
Navigator (CFD)
J. Witham (INHS)
Rocky (OHARE)

Conditions: poor observability due to large patches of bare ground, snow 1-2" drifts.

Counts

Location	No. Deer	Other wildlife
W/SW of runways 14R/32L	12	1 red-tailed hawk
NW of runways 14R/14L	1	1 red fox
E of runway 14L, N of 18	1	1 red fox
Totals	14 deer	

Narrative

The INHS/OHARE conducted a 42 minute helicopter flight to count deer on O'Hare property, 15 January 1986. Conditions for observing deer were poor, snow depth was 1-2", patchy, drifted, with large areas of exposed ground. Twelve deer were concentrated NW of "Blood Alley Road" (coordinates IJK/1 on Chicago O'Hare International Airport, Official coordinate map, Dep. of Aviation, 1978). These animals were in smaller groups (size 1-4 individuals) that changed composition when disturbed by the helicopter. One deer was sighted in each of the 2 remaining woodlots.

Construction W/SW of runways 14R/32L has reduced the size of this woodlot by at least one-half (coordinates A-G/1-5, Chicago O'Hare International Airport, Official coordinate map, Dep. of Aviation, 1978).

Appendix D. Aerial count of deer on O'Hare Airport made by Illinois Natural History Survey on 31 March 1987.

M E M O R A N D U M

TO Mr. Forrest Loomis, Illinois Dep. of Conservation (IDOC)
Mr. Russell Gebhardt, O'Hare Airport (OHARE)
Dr. Glen Sanderson, Illinois Natural History Survey (INHS)

FROM Dr. Jim Witham, INHS Urban Deer Study

DATE 31 Mar 87

SUBJECT Aerial count of deer on O'Hare property- 30 Mar 87

Search Time
Start- 10.58 Finish- 12.14 Total- 76 minutes

Aircraft Bell Long Ranger, Illinois Dep. of Transportation (IDOT)

Observers Pilot (IDOT)
J. H. Witham (INHS)
J. M. Jones (INHS)

Conditions extremely poor, no snow, clear

Counts

Location	No. Deer
W of runways 14R/32L	41 (includes 6 possible duplicates)
Between runways 14R/14L	0
E of runway 14L, N of runway 18	2
Totals	43 deer

Narrative

The INHS conducted a 76 minute helicopter flight to count deer on O'Hare property, 30 March 1987. Conditions were extremely poor for deer observations; no snow cover was present. We compensated for a lack of snow by flying < 150' agl. It is likely that some deer on O'Hare property were not observed. Deer were concentrated west of runway 14R/32L, north of St. John's Cemetery. Group sizes varied from 1-7 deer. Largest groups were near the nursery. Care was taken to avoid duplicate counts by repeatedly relocating groups previously sighted to verify their locations. A maximum of 6 of the 43 deer observed could have been duplicated counts. Two deer were sighted N of runway 18.

Construction has eliminated the woodlot SE of St. John Cemetery (approximately 25-33% of total wooded area on OHARE. Construction also was observed in the woodlot between runways 14R/14L.

Other wildlife observed during flight: Canada geese (numerous), cottontail rabbits (3), domestic cat (1), crows (numerous, one on nest), common flicker (4), great blue heron (2), Kestrel (1), mallards (numerous), pheasant (1), red fox (1), red-tailed hawk (2), unknown raptors (3), and woodchuck (1).

Appendix E. Conditions and draft budget estimate for deer removal on O'Hare International Airport by Illinois Natural History Survey.

Conditions:

1) That deer herd reduction be considered a cooperative effort among O'Hare Airport, Chicago Animal Control, Illinois Department of Conservation, and the Illinois Natural History Survey.

2) That O'Hare and Chicago Animal Control personnel:

   a) Maintain bait sites daily
   b) Help restrain and transport deer that are live captured
   c) Receive demonstrations and training in all techniques

3) Removal period 15 October 1987 - 1 April 1988

4) Under the conditions stated above, INHS could perform cooperative deer removal on O'Hare International Airport with the following compensation:

Personnel	
Assistant field technician (5 months @ $1,500/month)	$ 7,500.00
(Fringe benefits @ 0.15 of wages)	1,125.00
Transportation	
Vehicle rental, gas, and repair	3,000.00
Helicopter rental (3 flights @ $500./flight)	1,500.00
Supplies	
Drop net and supplies	1,500.00
Other	500.00
Contractual Services	
Carcass processing (20 carcasses @ $50.00/carcass)	1,000.00
Subtotal	16,125.00
Overhead (0.20)	3,225.00
Total Contract	$ 19,350.00