# 1987 GREAT LAKES DEER GROUP MEETING

Huronia Junior Ranger Camp
Anten Mills, near Barrie, Ontario
August 31 - September 3

The 1987 Great Lakes Deer Group Meeting was hosted by the Ontario Ministry of Natural Resources. It was held at the Huronia Junior Ranger Camp through the cooperation of Alex Smith, Huronia MNR District. Wayne Lintack organized many of the logistical aspects of the meeting, being responsible for accommodation and presentation facilities, meal organization and field trip preparation. Fiona McKay was involved with meeting correspondence, reservations, registration, accounting, sign preparation and airport transportation. Peter Smith was responsible for the audio-visual equipment and refreshments, as well as assisting with transportation. Mike Steeves assisted with meeting preparations, airport pick-ups and registration. Ray Stefanski provided Wildlife Branch funds required for Dale McCullough's trip. Dennis Voigt chaired the meeting, as well as being involved in all organizational aspects, setting the agenda and securing the guest speaker. Marie-Nietfeld took minutes and compiled the summary. Lotek Engineering, corporate sponsor for the meeting, provided the refreshments. For information on any Lotek product, please contact Lotek Engineering, 34 Berczy St., Aurora, Ontario L4G 4J9.

Accommodation, meals (at the Huronia Junior Ranger Camp), and the field trip were provided to attendees at a cost of $50.00 per person. Total number of registered participants was 44, though some part-time attendees did not register.

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* Not present, summary provided.

**DEER SEASON UPDATES - 1987 OUTLOOKS:**

Michigan (Ed Langenau): The Michigan pre-hunt deer population for 1986 was estimated at 1.25-1.4 million. More deer were taken (269,630) in 1986 than in the history of Michigan deer hunting. An estimated 226,970 hunters participated in the archery season, harvesting 57,960 deer (31,410 antlered; 26,550 antlerless). There were 205,340 deer (158,510 antlered; 46,830 antlerless) taken during the firearm season by an estimated 702,070 hunters. During the muzzle-loading season, an estimated 60,280 hunters harvested 6,330 deer (3,420 antlered; 2,910 antlerless). Buck harvest was down 12% as compared to 1985. About 39% of the antlered bucks checked from Upper Peninsula were 1.5 years-of-age, as compared to 73% in Northern Lower Peninsula, and 69% in Southern Lower Peninsula. Six-month-old deer comprised 31% of the total antlerless harvest, 20% were 1.5-year-old does, and 41% were 2.5-year-old or older does. Hunting effort increased about 10% for bowhunters from 1985 to an estimated 3.81 million hunter-days. Hunting effort during the firearm season rose 15% to 5.93 million hunter-days. Deer hunters were estimated to have spent $257,086,000 during the regular firearm season. Changes in 1986 regulations included a $3 fee from hunter choice permits, a second buck license during archery and firearm seasons (except in Upper Peninsula), and increased fines and a 3-year revocation of hunting privileges on illegally taken deer. The deer population is still on the increase, the 1987 pre-hunt estimate being 1.4-1.5 million deer. Even with the second buck license in effect, deer will probably be under-harvested in many regions. In order to control deer, Michigan may have to establish bag limits of 3-4 deer.

Minnesota (Mark Lenarz): The statewide 1986 deer harvest was down about 5% from 1985. Firearm permits issued totalled 417,068 with 129,770 deer taken (53% antlerless; 47% bucks). Antlerless permit holder success was 53%, while buck-only hunter success was 21%. Firearms harvest in the Itasca, Rainy River and Mille Lacs Management Units peaked in 1983 and has been declining since. The take from the Superior Unit has remained relatively constant. The harvest takes from these areas reflect the respective deer population status. Statewide archery information indicated 68,129 licenses sold, with 7,610 deer taken for a hunter success of 11.2%. Bucks comprised 44.6% of the take; 55.4% were antlerless. In the special muzzle-loader season, 812 permits were issued. Hunter success was 73% with 593 deer taken (15.2% adult males, 43.3% adult females, 21.1% male fawns, and 20.4% female fawns). Deer densities in Minnesota were estimated at 15 deer/sq mi; harvests estimated at 2-3 deer/sq mi. Minnesota started conservatively on the issue of antlerless permits, though later increases in issue of these permits may partially be responsible for the observed decline in the population. A cutback on the number of antlerless permits has been initiated, though this is being done slowly to maintain public support. Non-hunting mortality due to winter weather and predators may also be influencing the population decline.

Minnesota (Dwight Wilcox, Jim Ziegler; White Earth Reservation): In 1986, 40% of the tribal members par took in hunting. The number of permits issued was 1600, with 850 deer taken (50% success). The reservation is also opened to state hunting for a one week period, resulting in an additional 1,350 deer taken. Tribal members take most of their deer during this same week. Bucks-only season was in effect for two years, but the hunter success was low. The harvest now includes 50% does : 50% bucks. The deer population on the reservation has been stable for the last 5-6 years, and is lower than the surrounding region. The reservation population is probably being over-harvested, and mechanisms to lower the harvest are being considered.

Wisconsin (Keith McCaffery - was unable to attend the meeting but provided a summary): The firearm deer season in Wisconsin has traditionally been 9-day including two weekends. Most of the state is open to bucks-only (>3" antler) plus prescribed quotas of antlerless deer. The exception in 1986 was a 2+7 (2-day any deer, plus 7-day bucks only) in some units adjacent to the Mississippi River. About 3.2 million hunter days of recreation were exercised during the 9-day hunt. The archery season, running for a period of time during September through December, provides 83 days of bow hunting. Archers reported 4.1 million hunts during 1985. Deer populations have been increasing and reached a record pre-season population of about 1.1 million in 1985. This is well above our established goals, so the 1985 season was designed to reduce the herd (combined gun and archery harvest was 315,000 deer). In addition to the harvest, we had about 30,000 roadkills and a severe 1985-86 winter that probably reduced the northern herd by about 50,000. In 1986, 662,500 gun licenses were sold, with a harvest of 259,200 deer (45.5% were adult bucks); 216,200 archery licenses were sold, resulting in a take of 40,400 deer (47.3% were adult bucks). The combined gun and bow harvest was 299,600 deer. The fall 1987 population is expected to be about 975,000 deer. Statewide, we have set up 144,000 antlerless deer to be taken on quotas and expect a firearm harvest of about 270,000 deer. In addition, archers should again take 40,000 deer for a total of over 300,000 deer harvested for 1987. The big unknown is always the buck harvest. If hunting conditions are excellent, a conservative estimate of bucks taken in 1987 is between 5,000 and 10,000. Crop Damage: Wisconsin began a new damage program in 1983 which is administered at the county level. A $1 surcharge on all game licenses funds the program with about $1 million per year. Local Land Conservation Committees arrange for assessing damage, recommending mitigation, and making payment. Claims are limited to a $5,000 maximum and have a $500 deductible. In severe and persistent cases, fencing material is provided and the landowner erects and maintains it under a long-term agreement. In acute situations, shooting permits are authorized when other methods fail.

Wisconsin (Jonathan Gilbert - was unable to attend but provided a summary): This report includes the results of the 1986 off-reservation treaty deer season for the members of the bands of Lake Superior Chippewa Indians. The hunting occurred in northern Wisconsin and a portion of upper Michigan, in territories ceded by the Lake Superior Chippewas by treaty in 1837 and 1842. In 1986 a fourth interim agreement was negotiated between the Bands of Lake Superior Chippewa and Wisconsin DNR governing the exercise of off-reservation treaty protected deer hunting rights. This agreement provided for an 87 day gun deer-season just prior to Wisconsin's 9 day gun season. The off-reservation treaty bow season coincided with the state's bow season. The 1986 deer hunting agreement closely followed the 1985 hunting regulations. As in 1985, two tags were issued per tribal member. However, antlerless deer permits were valid for all deer management units and there was no limit on the number of permits issued. The Keweenaw Bay Indian Community had regulations already in place controlling their member's hunting activity in Michigan. The Mole Lake Band, not covered by these regulations, developed regulations similar to those of Keweenaw Bay. Carcass tags were issued and registration was required as in Wisconsin, but there was no antlerless deer permits or quotas established. There was a seasonal bag limit of 2 deer. Each of the Wisconsin Chippewa bands and the Mille Lacs Band in Minnesota were issued up to two tags per hunter for use in Wisconsin. The tribes authorized tags to be issued to any Wisconsin tribal member or members of the Mille Lacs Band or the Keweenaw Bay Indian Community. Antlerless deer permits were issued to hunters wanting them. Antlerless deer harvest quotas were established for each of the 57 deer management units. The tribal hunt was an either-sex hunt because the unlimited number of permits available permitted all hunters to have the opportunity to hunt antlerless deer. The total take was 2,145 deer, with antlerless deer making up 71.3% of the harvest (up 3% from 1985). Adult does comprised 53.6% and fawns 17.7% of the antlerless take. Antlered deer made of 28.7% of the total. The harvest was distributed among 23 countries of the ceded territory, though 78% of the harvest occurred in 7 counties.

Ontario (Ray Stefanski): The 1986 deer population was estimated at 200,000 - 300,000, having doubled over the last 7 years. The increase has been attributed to selective harvest and mild winters since 1980. Deer densities are now approaching carrying capacity for white-tail range on some management units and possibly above in some areas. The number of deer hunters in 1986 was 121,345 (up 10% from 1985); 36,357 deer were taken (up 26% from 1985), and hunter success was 30% (up 20% from 1985). The harvested take consisted of 44,5% adult males, 31.4% adult females, 14.0% male fawns, and 10.1% female fawns. Antlerless harvest (55.5%) increased 30% over 1985. For 1987, the allocation of antlerless tags is 71,055. It is estimated that the 1987 harvest will be over 40,000 deer. Changes for the 1987 season include experimental controlled harvests in the Simcoe and Niagara District to increase recreational hunting, selective harvest, and two 4-day hunting seasons. For 1988, there will be a provincial program of selective harvest and two seasons for some controlled hunts. A Deer Management Zone Program and a Deer Damage Program (3 Districts have reported serious crop damage) will be established. Winter feeding of deer is currently under review.

## HABITAT UPDATES

Minnesota (Jay Janecek): Two deer habitat programs have been funded in Minnesota. The Deer Habitat Improvement Program (DHIP) was started in 1969. Since the mid 1970's, $1/deer license was earmarked for habitat improvement. In 1980, this was increased to $2/license, providing $800-900,000 per year of habitat improvement funds. Sixty percent of the funding goes to personnel (habitat specialists and technicians) who work with foresters in coordinating timber sales and other forest management activities. The remainder of the money is used to purchase supplies and materials, and for direct project action. Eighty percent of the habitat work is directed towards the development and maintenance of forest openings, with about 3,000 acres opened per year. Openings are developed by clearing all trees and brush, double-discing the site, and seeding clover and grasses. Some sites are also fertilized. The average cost is $230/acre, including fertilization. Herbicides are the main method used to maintain openings. Tordon 10K is no longer available, thus Elanco Spike pellets will be used. The remainder of habitat work involves road and trail construction, prescribed burning and shearing. The burns range from 600 to 1,000 acres in size, averaging $17/acre. Eighty percent of the effort of the DHIP is directed at summer range improvement, 20% at winter range improvement. The Reinvest In Minnesota (RIM) program is two years old and is funded by the sale of bonds and general revenue - $16 million was appropriated by the 1987 legislature. $10 million has been directed to the Conservation Reserve program, which is designed to provide cover on erodible acres in the agricultural part of the state. The remaining $6 million will be used for both Fish and Wildlife Management. In NE Minnesota we will receive $250,000 in 1988 for deer and ruffed grouse habitat management, and $70,000 for moose habitat management. In addition there is a Critical Habitat Matching portion of the RIM program. A sportsman's club or individual can contribute either cash or land to the state, with the Critical Habitat Matching program contributing an equal sum, The club or individual can stipulate where and how the money is to be spent. The Minnesota Deer Hunter Association has already contributed money for opening development projects under this program.

Minnesota (Dwight Wilcox, Jim Ziegler): There are no funds available for specific habitat improvement activities on the White Earth Indian Reservation. They have started to work with reservation foresters to incorporate wildlife needs into the cut plan. The reservation is beginning to examine ways to market the current back-log of over-mature trees.

Michigan (Ed Langenau): Habitat and deer population goals for Michigan were set in 1972, with funds earmarked for a habitat improvement program. Habitat improvement personnel were divergent in philosophy as to which range was most important - summer or winter. The tendency was towards improving summer range and purchasing winter range (15,000 acres of winter range have been bought). Wildlife managers have worked in conjunction with forestry practices to maintain and improve habitat. Regeneration in cedar yards has been unsuccessful, succession leading to a balsam fir community. At present, 80% ($1.2 million/year) of the program funds is directed towards salaries rather than actual habitat improvement, creating some public non-support. Funding per county is weighted in relation to the potential for enhanced recreation against increased crop depredation and deer-vehicle collisions. Hunters continue to want more deer despite crop depredation problems. The goals set in 1972 have been met, yet the funding continues. Since it is unlikely that hunters would support the use of these funds for other projects, this program may not be continued in the future. Alternate areas which could use such funding include a general habitat improvement program for species other than deer, for research on deer, or towards deer crop depredation problems.

Ontario (Ray Stefanski): The deer program has been alloted $900,000. There is little funding available for habitat work. At present there are no earmarked funds for deer habitat improvement.

Ontario (Steve Elliot, Blind River): Cut proposals circulated by the forester are reviewed by a biologist before cuts can proceed. Wood production on summer/winter deer habitat is marked out. An attempt is made to remove mature trees without disturbing the habitat. Strip cuts of 100 ft width are also preformed. Openings are seeded after cut operations.

Ontario (Ernie Bain, Paddy Stiller; North Bay District): Loring Yards contain areas that were initially farmland which was left and has regenerated into poor quality deer habitat. There have been little funds available to do habitat work, though there is much potential for it. Habitat improvement on summer range has included the creation and maintenance of openings, tearing and seeding of fields, and prescribed burning. On winter range, soft maple has grown out of the reach of deer. The core yards at Squaw Lake and B[illegible]ais Lake are experiencing heavy deer use believed to be as a result of wolves harassing deer into a concentrated area. Deer do not maintain trails on the periphery of the yard when wolves push large numbers of deer into the core of the yard (where there is little browse available). A predator regulation program previously in effect has been terminated. Supplemental feeding is undertaken in the outlying yards to prevent deer from moving into the core.

Ontario (Bruce Ranta, Kenora): Deer are limited in their range distribution in NW Ontario, being found south of a line going from Sioux Lookout west. Deer in this region do not exhibit classic yarding behaviour although winter ranges are smaller than summer ranges and in many areas are definable as concentration areas. On identified deer range, all districts have involvement in timber management plans, both on Crown units and Company units. Five year forestry plans submitted must receive the approval of a biologist. Standards and Guidelines for deer habitat management are used. Cuts on deer range are small (about 50 acres), or are designed specific to the area being cut. Cuts are seeded with a clover/grass mixture and fertilized. This management not only enhances the area for deer but also for grouse and bear. In winter, cedar, balsam, and poplar areas are managed for deer. Cedar is cut on a block removal system, these cuts being the greatest input into deer habitat manipulation. Cedar regeneration will occur as deer forage on lichens to a large degree. On summer range, log landings are retained as natural openings, being seeded and fertilized, as are haul roads. Habitat is affected to a large extent by natural factors such as large-scale wildfires and spruce budworm infestations. The latter may be particularly significant given that balsam is a major component in some winter concentration areas. Balsam, when killed by budworm, becomes heavily colonized by arboreal lichens, principally Usnaria spp. Deer appear to depend or at least feed heavily upon these lichens.

Ontario (Wayne Lintack, Huronia): Little funding is available for habitat management. There is a need to retain available winter habitat for deer, and to determine critical sites. Areas are being lost as a result of clearing for farming practices and residential developments. There is an attempt to work with forestry personnel to maintain habitat or to produce cuts which are beneficial. Wintering yards contain lowland cedar. If cut there is no cedar regeneration, but rather a succession into balsam fir/ash. Cuts are discouraged in the core areas versus the periphery areas. Prescribed burns are planned for the northern area next year. Summer range is good, with little habitat improvement work occurring. However, in areas close to yards, where deer feed in adjacent fields, corn is grown or fields are seeded to alfalfa on acquired land.

## CURRENT RESEARCH UPDATES

Minnesota (Mark Lenarz): Field research has been limited in extent over the past 3-4 years. Current involvement is in modelling and evaluating the cost effectiveness of creating and maintaining various types of forest openings. The assumption is that forest openings improve deer habitat and increase winter survivorship. Foresters question the worth of the openings, and request that deer be given a dollar value that can be compared to forest products. Studies are required on deer use of a maintained opening and its importance to their survival, on the mechanical efficiency of the herbicide used to maintain the opening, as well as considering the economics of the deer harvest. A motion sensor camera located at forest openings is currently being tested as an indicator of deer use. A paper entitled "Economics of Forest Openings", in press with the Wildl. Soc. Bull., presents the results of the modelling efforts. The summary of this paper is as follows: Cost effectiveness is an ambiguous concept when applied to resource management. The determination of whether openings management is cost effective was dependent on which expenditures were included in the calculation of value/deer harvested. If only license revenues are included, it was difficult to economically justify openings management. If license fee and equipment and logistical costs were included, however, openings management appears cost effective within reasonable limits. Until it can be demonstrated that openings management increases productivity and/or survival, however, it is impossible to conclusively demonstrate the cost effectiveness of this product.

Michigan : An overview of a number of research projects occurring in Michigan was presented by Ed Langenau. Exerts from summaries provided will be presented here. Uses of Information from Summer Deer Observation Reports (Ed Langenau): The Department of Natural Resources has been gathering information since 1932 on the numbers of deer seen by employees during daylight hours between July 1 and October 31. The sighting rates show strong trends that are closely related to other measurements of deer density. This information is useful in forecasting hunting conditions, in recognizing areas where deer numbers are increasing or decreasing, and in better understanding deer herd composition, reproductive success, and mortality. The number of deer seen per 100 hours shows variation by area within state. Statewide, employees have reported seeing about one deer for every 4 hours afield. Changes in sighting rates have been similar to changes in the size of the herd in past years, and therefore can be used to indicate population trends. There is also some correlation between pellet count estimates of the prior fall's deer herd size and corresponding deer sighting rates in summer. In general, the reported composition of deer herds in recent years has been higher to bucks in southern Michigan and higher to does in Upper Peninsula. The percentage of fawns has been equal statewide.

There is some indication that the percentage of antlered bucks in the population may be higher than that reported in sighting data. A good correlation exits between adjusted number of antlered bucks seen per 100 hours in summer and the combined buck harvest per sq mi in firearm and archery seasons. The ratio of fawns:does in summer provides a useful index of productivity. Fawn mortality may also be estimated by comparing in utero counts (fetus:doe) with summer sightings (fawn:doe). Fawn mortality rates showed a good correlation with the Wildlife Divisions winter severity index in two of the three management units. It is concluded that the number of deer seen by employees in the summer is a useful index. Time spent to collect and compile this information is justified. Deer-Vehicle Collisions (Ed Langenau): A task force is investigating vehicle related deer kills. A number of factors are being examined (driver behaviour, vehicle type, seed mixture on highway ditches, mowing techniques, fences, medians, deer signs, reflectors) in order to make recommendations to lower these accidents. A report should be available in about six months. Preliminary Analysis of Antler Development Data (Rich Earle): Houghton Lake Wildlife Research Station, under the Penned Deer Research Program, has been investigating the effect on antler development among bucks maintained on an acorn supplement during autumn as compared to those not receiving this supplement. Sample size for each treatment group was 11 deer. Total antler points and main beam lengths, estimated through a spotting scope, were the two criteria used in this study to evaluate the effect of the supplement. All points in velvet that exceed or are nearly one inch in length were counted. Main beam length was estimated in "ear lengths". Measurements were taken July/August 1987. Total antler point distributions overlapped extensively between the two treatment groups. However, the means of the two groups differed significantly to suggest a treatment effect. Mean beam length distributions also overlapped extensively. Although the supplemental group appears to have longer main beam lengths, the differences at this stage in antler development is non-significant. These mid-summer observations did not show irrefutable evidence than an acorn-like supplement to a late fall diet will improve antler development. The data may become more favorable when antler development is complete and more accurate measurements can be taken. Sodium Requirements for White-tailed Deer (Rich Earle): The objectives of this study are to investigate to effect of three dietary sodium levels on gestation and lactation and growth of nursing fawns, plasma sodium, urinary sodium, and sodium balance. Thirty-six does, ranging in age from 1.5 to 8.5 years-of-age, will be used in three experimental treatments, which contain variations in the amount of sodium chloride in the diet. In October 1986, they will be allotted at random to 9 pens of 4 does each. A breeding buck will also be placed in each pen. All does will be weighed in January 1987 and at approximately 6 week intervals thereafter until their fawns are weaned in September 1987. At the time of weighing, blood samples will be taken for determination of plasma sodium, potassium and chloride. In addition, at least once during gestation, one pen of 4 does on each treatment will be placed in individual metabolism cages for a 2-day adjustment and a 2-day excreta collection. Sodium, potassium and chloride will be determined on feces and urine, and creatine will be determined on urine. Fawns will be weighed at birth, at 6 weeks of age and at weaning. Dietary Protein Concentration, Immune Response and Hoof Growth in Female White-tailed Deer (Rich Earle): The objectives of this study were to establish if dietary protein concentrations simulating winter or summer food supplies (both fed in winter) will produce differences in seroconversion to Jamestown Canyon virus and in rate of hoof growth. Twelve female fawns will be randomly assigned to one of two diets on December 15, 1986. Diet 1 will be a "no acorn" diet and contains about 7% crude protein. Diet 2 will be the HLWRS stock diet and contains about 16% crude protein. Weights will be taken initially and at 4 week intervals until all fawns show seroconversion. The length of inner and outer toes on the right side of each deer will be measured when the deer are weighed. Feed intakes will be recorded on a weekly basis. Measurements of seroconversion and titer will be made Dr. Paul Grimstad of Notre Dame University. Epidemiology of Jamestown Canyon Virus (P.R. Grimstad): The objective of this study is to determine the complete natural cycle of Jamestown Canyon virus (JCV) as it involves deer and humans in and adjacent to the Houghton Lake Wildlife Research Area. Seasonal timing of the seroconversion of 12 yearling does will be determined. Each animal will be bled weekly during the period of time when seroconversions are expected. Virus Isolation will be attempted on all deer bloods by enzyme-linked immunosorbent assay (ELISA) and Vero cell culture. Once each animal has seroconverted, it will be bled less frequently. ELISA will be used to detect the seroconversion. Thereafter, sera will be tested for neutralizing antibody in cell culture to determine the end-point titer and correlate ELISA optical density reading with end-point titers. Evaluation of white-tailed deer as amplifying/disseminating host for JCV will be accomplished by inoculating one-half of the seronegative fawns born in 1987 with JCV, and measuring the level and duration of viremia. This will be done in the late fall when no potential vectors are present. Uninfected adult mosquitoes will be permitted to feed on the viremic deer, and their ability to become infected and transmit to suckling mice determined. Differences in rate of infection and transmission resulting from engorgement on the deer versus a membrane feeder with defibrinated deer blood and JCV will be determined. If the rate of infection can be duplicated in the laboratory, it will permit better assessment of the vector competence of different mosquito species and ascertain the probability of viral dissemination when mosquito "A" feeds on a viremic deer versus mosquito species "B". Duration of virus transmission will be determined by using nubian goats as sentinel animals. A pair of goats will be brought to the penned deer facility weekly after all deer have seroconverted. Blood samples will be taken, and seropositive goats replaced weekly until seroconversion among goats ceases. Cusino Wildlife Research Station Summary (J. Ozaga): Studies to determine the effects of various harvest strategies upon deer social behavior, and subsequently upon their reproductive performance, have continued in the square-mile Cusino enclosure. Earlier investigations showed that changes in deer herd density and sex-age composition can alter deer behavior patterns and impact upon their population dynamics just about as effectively as nutrition. However, our recent efforts to induce breeding among doe fawns and to raise productivity among yearling does by lowering population density and minimizing social domination of young females by older does have met with little success. The growth rate of fawns has improved markedly as the result of supplemental feeding, as they now run about 40% to 50% heavier than prior to diet supplementation. In fact, 84% of the buck fawns present in recent years have grown "infant" antlers. Nonetheless, only 1 of 24 (4%) doe fawns present in the young doe herd has bred; a rate no better than that of wild deer in the immediate area. Futhermore, altering the age composition of the female population has not noticeably improved the reproductive performance of the yearling does. Thus, a high incidence of "infant" antlers among buck fawns may not indicate frequent breeding among doe fawns in the same population, at least not when deer density is relatively high (>13/sq km), regardless of nutrition, because social/density factors still suppress fecundity among young subordinate females. Data are currently being analyzed to determine if white-tailed doe social classes can be delineated based upon their behavioral and reproductive traits, as proposed by Bubenik for most ungulates. An analysis of data gathered over a 9-year period revealed that mother's age, progeny sex ratio, and birth date among captured/tagged newborn fawns did not differ from that for fawns not handled as newborn. However, fawns we captured and tagged suffered significantly less mortality than expected. Ongoing studies of adult buck social behavior patterns have continued on a year-round basis within the enclosure, and will be completed next winter. Data from this investigation will likely support present theories regarding a distinct niche separation of sexes. A survey of deer "scraping" activity conducted in 1986 revealed that, except for occasional sporadic scraping in April, such scent-marking behavior is pretty much limited to the courtship and breeding period in autumn.

Wisconsin (Keith McCaffery): We annually age deer at about 75 of our 475+ registration stations. Over 18,000 deer were aged in 1986. Deer populations are then calculated for each of over 100 deer management units. These density estimates relative to established goals provide the basis for setting antlerless quotas for the following fall. A statewide reinventory of deer range was completed in 1986 and a statewide reproduction survey finished this spring. A continuing study of forest openings is nearing completion in our northern forest, and a number of studies on the Sandhill enclosure are in the writing phase. Analyses on these studies are continuing, so not much can be said about results. A new study of the impact of forest conversion to red pine is just underway. A description for our most current population reconstruction technique is: Yearling Buck Percents: The YB% (among bucks 1.5 yr and older) estimates the total mortality rate on adult bucks when the herd is stable. A herd is never stable, so we use a long-term (10 yr) mean YB% to estimate mortality in each unit. Yearling Doe Percents: The YD% (among adult does 1.5 yr and older) is a product of the recruitment to age 1.5 and therefore is relatively unaffected by changing mortality rates. However, when the herd is stable, mortality matches recruitment. Thus, we use the long-term YD% as an estimate of doe mortality. Adult Sex Ratios: If bucks and does are born in approximately equal numbers (110 b/100 d) and we have estimates of their mortality rates, an adult sex ratio can be estimated by dividing the buck mortality rates by the does morality rate. Fawn Production: Net fawn production can be approximated by direct observations, manipulating YD%, shot samples, etc. Herd Ratio: With mortality directed primarily at adult bucks, the above information will normally result in a ratio of about 1 adult buck to 2 adult does and 2 fawns, but varies depending on buck mortality and fawn production. Buck Harvest Mortality: If one can make an estimate of non-harvest losses of adult bucks (e.g., 20% non-harvest loss), the recovery rate (80%) times the mortality rate equals the harvest mortality. Expansion Factor: The herd ratio divided by the harvest mortality provides a factor that can be multiplied times the adult buck harvest to produce a preseason deer population estimate. In farmland, this factor ranges from 6.5 to about 8. In extensively forested zones, the factor may range from 8 to more than 20 depending on hunting effort (exploitation).

Wisconsin (Tim Lewis): Two areas of research were identified. 1) Crop depredation is a serious problem in some areas. There is a need to find a means of inhibiting deer use of expensive crops. 2) In NW Wisconsin, there has been a steady decline in the number of deer. The relationship between deer density and forest cover (forest cover has changed in this area over the last 150 years) is being analyzed. There is a need for specific deer numbers in areas where deer densities are very low and thus difficult to manage. Investigations into migration and dispersal patterns of deer are being conducted. Supplemental feeding is being considered as a potential means of reducing the decline.

Ontario (Wayne Lintack, Huronia): Information on deer population dynamics has been sparse in the past. Road-killed deer were the source of most of the information collected; 900 deer have been necropsied in the last four years. Data obtained from these deer include sex, age, size measurements, body condition indices, and reproductive performance. The Ontario public now has the right to keep road-kills, thus decreasing this source of information. Information is also obtained from hunter check stations and from stations and from mandatory hunter reports. There is a need to gather baseline data on population characteristics which, through modelling, can be used for predictive purposes.

Ontario (Midge Strickland, Parry Sound): Reproductive success of does has been examined by sectioning of ovaries from hunter-kill samples obtained from check stations, and from embryo counts on road-killed does. These two methods are being compared to see if any relationship exists. In the Algonquin area, no fawns or yearlings bred. Overall, there was <1 fawn:doe-of-all-ages. The Loring deer herd have a similar reproductive rate to deer in Algonquin, whereas does in the Huronia area are more productive.

## RESULTS FROM ONTARIO'S COOPERATIVE DEER STUDY

Overview (Dennis Voigt, MNR Wildlife Research): The Cooperative Deer Study is a large-scale field project designed to address two issues of Ontario deer management: winter feeding of deer and methods of regulation of herd levels. This study is organized to foster the involvement of researchers, managers at the district and regional levels, university graduate students and professors, and organizations such as the Ontario Federation of Anglers and Hunters and Northern Ontario Tourist Operations. The study is being conducted in 4 areas - WMU47 near Loring, Huronia District, Wingham District and Rondeau Provincial Park. The advantages of these comparative studies are partially offset by additional logistical costs, staff shortage and funding limitations. We have integrated projects into the study that would be not as feasible or profitable if done separately. Two graduate students, Hamr and Schmitz, receive ORRGR funds for post-doctoral work and 2 other Masters candidates, Bellhouse and Guy, are integrated into the study. MNR district staff in each area have been involved in conducting field studies designed at workshops held 2-3 times a year and attended by cooperators. MNR Wildlife Research Section staff and 3 contract biologists provide liaison and coordination of all the projects. The major objectives of the population ecology studies are: 1) develop and/or test techniques and parameters to assess the condition of a deer or a deer herd, 2) develop and/or test techniques that deer managers can use to measure i) productivity, ii) recruitment rates, and iii) rate of increase of a herd, 3) determine mortality rates and cause of death for deer during all periods of the year, 4) determine the movements and migration of deer between winter and summer range including the harvest period, 5) determine the effect on productivity and recruitment of i) hunting, ii) weather (winter and summer), iii) deer behaviour, and iv) habitat, 6) develop a comprehensive spatial, stochastic computer simulation model of deer in Ontario. The model would be based on a WMU basis for deer managers and operate using results from this study, literature and local surveys. The major objectives of the feeding experiment are: 1) evaluate the design and use of feeders, 2) determine the number of feeders required in an area including the distance between them, 3) determine the number of deer using a feeder including the percentage of herd reached, 4) determine acceptability by deer of feed rations such as a pelleted total diet and corn/oats. Evaluate cost of these rations and prepare guidelines for usage based on energy, protein and nutrient requirements of deer, 5) develop guidelines for a schedule of feeding during the winter based on winter severity index and the capacity of deer yards to maintain a number of deer.

<u>Deer Migration Behaviour and Management Implications</u> (Jim Broadfoot, Lotek Engineering, Aurora): The timing and distance of migration by radio-collared deer in southern and central Ontario was investigated as part of the Cooperative Deer Study. The majority of deer are migratory from winter to summer ranges, with migrations being variable among years and areas. Most deer leave their summer home ranges around the first week in December, although much variation occurs. Long distance migrators (>50 km) tend to leave summer home ranges early (September, October), travel part way (1/3-1/2 distance) then establish an interim range which is used for 1-2 months before continuing on. Most deer arrive on winter range and stay there during January. Deer are very responsive to snowfall (>15 cm accumulation) and subsequent melting. This results in "flip-flop" migrations, with some deer migrating to and from winter ranges as many as 4x per month. This pattern is most commonly displayed by short distance migrators (<15 km), and occurs more commonly in autumn than in spring. Most migratory deer spend about 100 days on winter range. The length of time deer spend on winter range may be influenced by winter severity, available browse, population size, and supplemental feeding. Deer migration off winter range appears to be related to snow conditions and temperature. Duration of dispersal varies from just a few days to several weeks. By mid-May most deer are on their summer ranges. The maximum straight-line migration distance was 97 km, with deer in southern areas migrating shorter distances than those in the central region. There is a prevalent directional bias in the migration pattern of deer off most winter ranges. There is no overlap of summer range shown by migrating populations from adjacent winter ranges. A positive correlation exists between winter range size and summer range size. Management implications of temporal patterns of deer migration include: 1) a biological criteria for setting hunting season dates depending on management goals, 2) the impact of the immediate winter weather on deer will be influenced by their location in relation to summer/winter range, 3) the length of time that deer spend on winter range will determine the pellet deposition period and therefore influence population estimates determined by pellet group counts, 4) the time that deer spend on winter range will influence the number of deer-day use of that range, and therefore the potential carrying capacity of that range. Information from spatial patterns of deer may lead to the

development of a spatial model which would allow prediction (within some acceptable degree of error) of the size and shape of the summer range defined by a population migrating away from a particular winter range. Through changes in harvest allocation, managers could alter the number of deer on a particular wintering range depending on their management objectives.

Condition Indices of Deer (Joseph Hamr, Univ. Guelph): Blood samples, body weight, body measurements and several fat indices were taken from dead deer year-round as well as from live-captured deer during winter in different regions of central and southern Ontario as part of the Cooperative Deer Study. Blood serum was analyzed for the metabolically active hormones thyroxine (T4) and triiodothronine (T3) by means of highly specific radioimmunoassays. Seasonal fluctuations in T3 and T4 were compared to variations in other indices of nutritional status. The annual cycle of body condition and metabolism was established for Ontario deer. Preliminary results showed differences in body weight, subcutaneous fat layers and the levels of T3 and T4 between geographical region, supplementally fed versus unfed deer, as well as between subsequent years and among sex-age classes. Levels of T3 and T4 exhibited a yearly cycle, peaking in June-July, and again in January. Deer from regions with poor quality forage had lower levels of these hormones than those from areas of higher quality food. Deer that were supplementally fed had higher levels of these hormones as compared to those none-fed. Starved deer exhibited minimal values of T3 and T4. T3 is a better metabolic indicator than T4; T3 illustrates differences in the metabolism of sex-age classes more clearly than T4. Marrow fat was the highest from September to January and the lowest in March and April (down to 20%). Organ and back fat were highest in September to November, and lowest in February and March. The greatest fluctuation in body weight occurred in bucks >2 years old. Fawns of both sexes and reproductively active bucks were most susceptible to fluctuations in body conditions. Weight loss in bucks begins during the rut, and they continue to lose weight during winter. They are the first to lose subcutaneous fat in January. Fawns lose weight over the winter, from January to March, despite their growth during this period. Yearlings and mature does exhibit very little fluctuation in weight loss throughout winter. For the winters of 1984-87 at Loring, trends of T3, T4, rump fat, body weight of adult females, and body weight of fawns were lowest for deer on natural browse, intermediate for deer on corn/oats supplement, and highest for deer on a pelleted ration. Variation in body weight and xiphoid fat in yearling males was observed between geographic regions - deer from southern areas had greater body weight but lower xiphoid fat when compared to central areas. Body weight, subcutaneous fat layers and levels of T3 and T4 are potentially reliable indices of deer nutritional status. Such indices can help wildlife managers to evaluate the adequacy of summer habitat, predict the danger of deer die-offs during winter and to correctly implement supplementary feeding programs. A statistical analysis is necessary to confirm the results obtained to date.

Winter Foraging Strategies of Deer (Oswald Schmitz, Univ. Michigan): Presented was the idea that foraging strategies/behavior can be treated in a hierarchial manner: 1) when in a day and how much time in a day to feed; 2) which proportion of different food classes (eg. conifer or deciduous) should be included in the diet; 3) which range of twigs should be consumed when feeding on a single food class. Data were collected on foraging behavior of deer in the Loring area over two winters to investigate the above questions. Results are summarized as follows: 1) Feeding time: Deer forage is usually located in exposed habitats, which can result in considerable heat loss by deer while foraging. Therefore deer must trade-off resting in sheltered cover to minimize heat loss with foraging in exposed habitats to gain energy for survival. Deer tend to forage during hours that have the least thermal cost - around sunrise, late afternoon to past sundown, and near midnight. An activity/temperature interaction is apparent. Maximum activity level occurs within -12 C to -1 C. Activity decreases when the temperature falls out of this range. As a result, the thermal environment can constrain activity and feeding if temperatures get too cold or too warm. Deer in winter coat may be constrained to such an extent that they may not be able to forage long enough to satisfy their food requirement. 2) Foraging strategy-Food class choice: It is possible to use an economics model that predicts the proportion of conifers and deciduous browse that deer should include in their diet given: i) deer are constrained by gut processing capacity, daily feeding time and minimum energy requirements; ii) deer cannot consume conifer twigs when foraging on deciduous twigs. The model appeared to adequately predict foraging behavior of deer in three parts of winter. The relative food value to deer of conifer and deciduous components changes as the different foods are depleted by continual foraging. Thus, single types of food resources cannot be assumed to have the same food value as winter progresses. This may be important when evaluating the carrying capacity (K) of the deer range, i.e. K varies temporally as relative food value changes. 3) Foraging Strategy-Twig Selection within a Foodclass: Deer do not always use all twigs available in their environment. There will be a minimum size or quality that will enable deer to satisfy their energy requirements for a given feeding time and cropping rate. This minimum size can be predictably manipulated through supplemental feeding to cause deer to increase or decrease the range of twigs they will eat. Therefore, through supplemental feeding it is possible to make deer more efficient in their use of available twigs or minimize browsing pressure on available resources. That deer are selective also has important implications for estimating K. If it is assumed that all twigs on a habitat are usable, the K. will be overestimated.

<u>Selected Results from Analysis of the Canonto Deer Study, Measurement and Age Data</u> (Anne Lambert, OMNR): 1) An inverse relationship with the population index could be seen in all measurement variables looked at (dressed weight, heart girth, total length, hind foot length, antler beam diameter, and number of antler points). 2) The greatest negative correlations were seen with dressed weight in males less than age 4.5 (particularly in the 3 youngest age groups), and with hind foot length in male fawns. (Antler beam diameter is probably at least as good as weight in reflecting population level, but there are too few data for this variable to draw conclusions.). 3) Mean buck weight was correlated with population indices going back at least 5 years earlier, however mean doe weight was only correlated with the population index of the current year. 4) The extent of the variation in male weights as a result of differing population levels may have been as much as 13-15% for fawns, yearlings and bucks aged 2.5, over the complete range of population levels experienced during the study. 5) Substantial negative correlation with the winter severity index was found with beam diameter, number of antler points, and male fawn weights and measurements. 6) Male fawn weight was more correlated with mean doe weight in the same and preceding years than with the population index. 7) The percent of does lactating was uncorrelated with he population index, but there was weak negative correlation with the winter severity index for does aged 3.5 to 7.5. 8) The fawn:doe ratio showed weak, non-significant negative correlation with the population index in the previous year and with the winter severity index. There was no apparent correlation with the severity of winters before the preceding one or with a variable that averaged the severity of 2 or 3 preceding winters. 9) The fawn:doe ratio was positively correlated with both mean buck weight and mean doe weight averaged over the current and preceding years. 10) Estimates of yearly rates of productivity calculated from age frequency (and effort) data also showed positive correlation with mean buck weight in the preceding year. 11) The number of yearling males as a proportion of all bucks (yearlings and older) was negatively correlated with the winter severity index (preceding winter) and was positively correlated with mean fawn weight in the previous year. 12) A buck index made up from bucks aged 2.5 and over gave higher (negative) correlations with measurement variables than did the standard buck index, which includes yearlings. It was also more highly correlated with population estimates from pellet group surveys (available for 10 years). 13) Some preliminary work has been done on a population model which uses measurement variables (mean dressed weight of yearling males, and mean dressed weight for all bucks, adjusted for age differences). A simplified model predicts the proportional change in population level from the level of hunting effort and mean weight subtracted from the estimated theoretical value of weight at "zero population". A winter severity term was also tried but proved non-significant.

The "weight index" term in combination with the constant determined from the regression represents the potential of the population for growth, which ranges from zero at carrying capacity to a maximum value at the theoretical maximum value of the measurement variable (i.e. these terms express logistic population growth). The weight variable seems to have several advantages over a population density term in such a model. The model produces estimates of the values of the weight variable and the effort variable that should correspond to maximum yield (potential harvest) in a stable population (zero growth). The estimates derived from the first runs of this model indicate that for maximum sustained yield, the hunting effort should be lower than it has been throughout most of the study, and the weights of bucks should be a bit lower than the long-term average for the study. This translates into population levels that are towards the high end of the scale of those experienced during the study. In fact, the selective harvest system (in place since 1980) has so far had the effect of working towards both of these ends. It should be emphasized that this is just preliminary work, done to test out the use of measurement variables in a population model. General Conclusions: The Canonto data provide further evidence that the body size of deer is quite sensitive to population density effects, even in a population at low or moderate population densities (relative to habitat). Measurement variables such as buck weight (or beam diameter) appear to be more closely related to productivity and to the potential of a population to grow (in the absence of hunting and other traumatic mortality) than is the population density. They therefore have an important potential value in population models. The absent or small effect of winter severity in population models used with Canonto data presumably relates in part to the relatively good physical condition of the herd during the course of the study, which may have generally prevented high mortality from severe winter conditions.

Population Dynamics of White-tailed Deer in the Canonto Study Area, Ontario (D.J.T. Hussell, OMNR): Data on age and sex composition of the harvest and hunter effort were obtained for 32 years (1954-1985) from a 230-km$^2$ area in southeastern Ontario (a smaller area was monitored in some of the earlier years). There was an any-deer hunting season each year in early November from 1954 until 1979. In 1980-85 there was a selective harvest in which any hunter could take a buck, but there was a limited quota of hunters who could kill antlerless deer. A multiple regression analysis showed that buck harvest on any day of the hunt was influenced by hunter effort (number of hunters per day), the day of the hunt, the year and weather. The co-efficients of the year variables yielded a buck population index, representing change in population size over the course of the study. The population was high at the start of the study, declined to lower levels in 1955-57, and recovered to high levels by 1960. There was a gradual decline in the 1960s and a more rapid one in the 1970s. By 1974 the population had reached the lowest level recorded, but the decline continued until 1979 when the population index was less than half what it was in 1974 and a quarter of the value for 1960. After introduction of a selective harvest in 1980, the population rebounded and by 1984 was t a level comparable to those of 1954 and 1960. A second multiple regression analysis showed that the buck population index could be predicted by a combination of the buck population index two years earlier, the doe harvest two years earlier and an index of winter severity for the winter 1 1/2 years preceding the hunt. Increase in the buck population index was density dependent and the negative impact of doe harvest was greatest when the population was low. Buck weights were negatively related to buck population index and the number of antler points of yearling bucks was negatively correlated with both winter severity and the buck population index.

Review of Snow Courses in Ontario (Peter Smith, OMNR): In 1986, the Wildlife Research section initiated a survey of snow courses throughout the province. The purpose of the inspection was fourfold: 1. Assess standardization of equipment and data collection; 2. Review techniques and maintenance schedules; 3. Encourage discussion and feedback with field staff; 4. Collect material on snow measurement and winter severity indices for provincial standards and guidelines. The following notes present a brief summary of comments. Snow Courses: Many of the provincial snow courses were established years ago and little thought has been given to the continual changes taking place in the forest stands each year. Natural succession and disturbance, plus man's activities within the forest all contribute to conditions which effect snow measurement. The most common faults encountered during the inspections were (1) the plastic facers on snow depth meter sticks were not zeroed at ground level and (2) physical obstructions (young conifers, branches and logs) were not removed from around the individual stakes. Both conditions would produce readings of abnormal snow depths. As a result of the inspection, 9 snow courses were relocated to give better (more representative) readings. In 5 cases, the conifer component in the stand was too high to give proper measurements; logging activity forced the relocation of 3 sites; and in one case, the course was located in a lowland area which was subject to continual flooding. In conclusion, the majority of snow courses were well laid out and with a little maintenance should continue to give good measurement of snow cover. Snow Penetration Gauge (SPG): It was found that many SPGs had stiff mechanical actions due to oxidation of the internal parts and therefore required more downward pressure than recommended. With a few minor exceptions, the equipment was maintained in original condition when 3 simple guidelines were followed: 1) place SPG upside down to dry after using; 2) clean and lubricate SPG at the end of the season; 3) store in container when not in use. Minor changes were suggested in snow course layout to improve the quality of the SPG readings and ensure that the readings reflect true snow support conditions and not other unmeasurable or unknown factors. The improvements involved locating individual stations on level sites away from hummocks and depressions and removing physical obstructions (including woody stemmed vegetation) from within 2 m of the stakes. Two commercial products were tested in an attempt to reduce friction and prevent oxidation on the spring and aluminum and copper tubes of the SPG. A Teflon spray did not stick well to the metal surfaces and tended to flake off when dry. Another product CRC 3-36 was successful in lubricating all surfaces, and preventing rust. Field testing in winter will confirm the properties of this product in cold temperatures. Chillometers: In 1986, the province adopted a standardized system in which the chillometer and meter board were separated into two units. This modular system improves repair and replacement procedures. Units can be removed for annual cleaning and storage which will prolong the life of the equipment and decrease vandalism. The maintenance staff at Maple must be given full credit for the servicing and repairs to the chillometers, plus the design and construction of the meter boards. Without their assistance, many of the improvements would have been impossible. In conclusion, 92 snow courses reported measurements of snow cover and crust conditions, 31 snow penetration gauges (SPG) were used to provide sinking depths and 12 chillometers were fully operational during 1985-86. From the above, 39 snow courses were inspected, 31 SPGs were serviced and 23 chillometers were repaired. An additional 5 chillometers were built and 9 others were inspected on site and scheduled for recall in 1987. As in previous years, provincial snow course reports were summarized and sent to Environment Canada for publication in their annual publication "Snow Cover". Work began on writing a standards and guidelines for snow measurement.

**GUEST SPEAKER: Dale R. McCullough - Strategies of Deer Management**

Deer management involves the integration of three main elements: 1) What are the ecological capabilities and characteristics of the environment producing the deer population? 2) What is the current status of the deer population? 3) What are the hopes and desires of the interested public with reference to the deer population? These three elements are intertwined, and therefore they must be solved simultaneously.

One of the first things the manager must assess in deer management is the degree to which density dependent population mechanisms are determining population size and rate of turnover. In some cases and, at some times, density is important, and in others predators, climate, and other variables completely swamp the density response. If density is the predominant variable, then the manager is in a position to actively manipulate density to increase yield and population turnover. However, if other variables consistently override density in importance, the manager is forced into a passive role (reactive, or ad hoc) in management. In the latter case, yields must be either extremely conservative or taken when fortuitously presented. Assuming that nature is the most important variable, when in fact, density is, results in the manager suffering lost opportunity and misdirected effort. Assuming density to be the predominant variable, when in fact other variables are, results in overharvest. Overharvest is usually a punisable sin, whereas lost opportunity or misdirected effort tends to be overlooked. Might not data show that most managers have made few mistakes but also have not done a very good job with their opportunities and spent a lot of effort and money on projects giving little or no return?

Clearly, deer populations on the fringes of the distribution, where physiological tolerances are being stretched (by winter in the north and drought in the south), are most likely to be controlled by weather variables. In more benign environments and where effective predation has been reduced or eliminated by man, density is likely to be more important. Nevertheless, local weather patterns and migratory behavior complicate the picture. A useful starting place to assess the effects of weather on deer populations in a given locale is to examine long term weather records for frequency distributions and time patterns. A frequency distribution of good and bad years that shows a central tendency would suggest a strong possibility that density dependence would be a predominant variable. In situations where most years are good, interspersed with occasional bad years, density dependent strategies would probably be useful, even though one would have to respond, on an ad hoc basis, to adjust for the effects of a bad year when it occurs. Where bad years occur in high frequency with an occasional good year, and where good and bad years occur more or less at random are poor situations for pursuing density dependent management, and generally conservative management on an ad hoc basis may be the best that can be achieved.

Three other points must be kept in mind in dealing with highly variable environments. First is the possibility that series of good and bad years may occur with some regularity, if not cyclicity, in which cases ad hoc management during bad cycles and density dependent management during good cycles may be possible. Second, one needs to examine the timing of the effects of the bad weather relative to timing of possible harvest, and manage accordingly. Third, an entirely different strategy might be adopted in the case where weather is unpredictable and has a timing that does not allow adjustment of harvest. The natural tendency in these situations is to pursue conservative, hoc strategies of management. An alternative is a much more aggressive strategy to exploit the lower end of the growth curve where recruitment rates are high, and maintain consistently low densities that are less susceptible to severe winters when they do occur. Low density management would result in most of the recruitment during favorable years being removed in the harvest, rather than being lost to winter mortality. The lowered density that optimizes the combination of high yield and low winter mortality would have to be established empirically over time, and would be dependent on good estimates of population size (or density) and harvest. Because it is a strong departure from the conservative policies of the past in such situations, implementation of such strategy will require education of the user groups, and broadly based support for the experiment of shifting from an ad hoc program to a purposefully aggressive, low density program. The inverse relationship between standing crop in the field and yield should be reminiscent of the same relationship in density dependent management as one shifts a population from K towards I.

A second indicator of environmental variance is the stability of the kill over the years. If hunting effort has been more or less constant and the deer population size has not changed greatly, a more or less constant kill would be expected. If hunting effort has been fairly constant and kill has varied substancially, the first assumption would be that environmental variation has been high, and has influenced the size of the deer population. Thus, with a constant hunting effort, kill varied with the size of the population being subjected to hunting. In any event, fairly consistent kill statistics would ordinarily indicate a deer population with relatively low environmental variance, and high opportunity for density dependent management.

The density dependent population of deer can be managed for high yield near I carrying capacity or low yield near K carrying capacity. Near K, low yield is correlated with high standing crops in the field, whereas near I, high yields are correlated with lower standing crops in the field. The consequences of mistakes in management of the harvest are minor if the population is on the right hand arm of the yield parabola, and major if on the left hand arm. This is because the density dependent response on the right arm works to oppose, and, thus, correct for the errors in harvest, whether it is too high or too low. Consequently, the right arm of the harvest parabola is a fairly stable region. The left arm, conversely, is highly unstable under most circumstances. To maintain a constant residual population in this region of the yield curve, tha annual yield must be determined accurately and be removed exactly each year, which is virtually impossible given the variation in recruitment and inefficiences in population management techniques. If less than the annual net recruitment is harvested, the residual population increases, and if more is harvested the residual population declines. A continuing of harvesting "errors" could lead to decline to extinction with overharvest. The exception to overharvest driving the population to extinction is the existence of a refuge effect that prevents the harvest from being obtained when the population drops to a certain level.

Correct or adjust year by year

The above discussion has outlined the various opportunities and constraints presented to the deer manager by given deer herd units. By definition, constraints are unmanageable, and both manager and society must accept them as unavoidable costs of being in the deer business. It is the opportunities that need to be addressed by managers and society. Opportunities, by definition, involve a matter of choice. These choices invariabaly involve "good news, bad news" kinds of tradeoff.

The manager plays two roles: that of a scientist in establishing the constraints and the opportunities in a given management unit, and that of an artist in making choices that satisfy human expectations and desires from the deer herd. Yield is but one of the benefits of a deer herd; hunters are a minority. Even among hunters, the quality (trophy, experience) versus quantity (hunter success, total harvest) tradeoff can be a complicated choice.

**FIELD TRIP**: A field trip to a periphery region of a local deer yard followed McCullough's presentation. Discussion on management constraints and strategies continued with respect to the deer habitat observed. The group examined a good quality summer range at the edge region of a hardwood forest. The vegetation was noted to be more productive than that of northern Minnesota, and thought not to be a limiting factor for deer. This was contrasted by the winter yard, characterized by a dense conifer canopy and a dramatic decline in forage production. A discussion on winter yard quality, supplemental feeding, and habitat improvement ensued. Finally, a corn field planted by F&W was examined. Ontario weather cooperated for an enjoyable afternoon.

**GROUP DISCUSSION**: MAJOR ISSUES, MANAGEMENT AND RESEARCH NEEDS FOR DEER AT THE NORTHERN LIMIT.

Attendees were randomly placed into four groups to discuss major issues, management and research needs for white-tailed deer during a casual evening session. A spokes-person reported each groups ideas the following day. Despite variations of a local nature, groups reported relatively consistent results, summarized below.

Major Issues: Direction of management is unclear. Who are we managing deer for? There is a need to establish and evaluate management goals.

Major Management Needs: To determine the relationship of deer, habitat, and users. Items include setting population goals, evaluating management actions.

Research Needs: Criteria and methods to evaluate population status in relation to habitat and harvest goals. How to assess effects of management.

**OTHER BUSINESS**: The format of the Great Lakes Deer Group Meeting was discussed. It was concluded that the informal nature of these meetings should be continued and that the accommodation/presentation facilities used in the past have been adequate. It was agreed that the meetings should continue on a yearly basis with the hosting agency selecting the most appropriate date. The program for the meeting could emphasize contributions from the hosting state or province since this allows for discussions within the hosting region as well as with other regions. Attendants presenting information should provide summaries or abstracts to the hosting organization. The hosting organization will then be responsible for providing a summary of the presentations to visiting groups, which, in turn, will be responsible for duplicating and distributing these summaries within their province/state. It was suggested that a master mailing list be created on computer diskette and updated every four years. Ideas for themes for upcoming meetings should be proposed to the hosting province/state. The possibility of inviting a guest speaker to future meetings will depend on the hosting organization.

The next meeting will be held in eastcentral Minnesota. Lee Hemness or Mark Lenarz can be contacted for information. Joint meetings with the entire NE Deer Group are not probable because of the size of the meeting. Members of the NE and midwest group should be invited to attend the Great Lakes Deer Meetings.

# GREAT LAKES DEER GROUP
## 1987 ATTENDEE LIST

Ernie Bain, OMNR
P.O. Box 208
Powassan, Ont. P0H 1Z0

Jim Baker, OMNR
99 Wellesley St. W., Room 2320
Toronto, Ont. M7A 1W3

Tim Bellhouse, OMNR
c/o General Delivery
Golden Valley, Ont. P0H 1N0

Jim Broadfoot, Lotek Engineering
34 Berczey St.
Aurora, Ont. L4G 4J9

Mike Buss, OMNR
Leslie M. Frost Centre
Dorset, Ont. P0A 1E0

Bob Chesness, DNR
1201 E. Hwy 2
Grand Rapids, MN 55744

Bill Creighton, OMNR
R.R. #5
Wingham, Ont. N0G 2W0

Greg Deyne, OMNR
Box 1138
Bracebridge, Ont. P0B 1C0

Dave Dickey, DNR
502 Minnesota Ave. N.
Aitkin, MN 56431

Steve Elliott, OMNR
P.O. Box 190, 62 Queen St.
Blind River, Ont. P0R 1B0

Joseph Hamr, Laurentian Univ.
c/o General Delivery
Alban, Ont. P0M 1A0

Lee Hemness, DNR
1201 E. Hwy 2
Grand Rapids, MN 55744

Dave Hussell, OMNR
P.O. Box 50
Maple, Ontario L0J 1E0

Tom Isaac, Dept. Wildl. Ecol.
226 Russell Labs, Univ. Wisconsin
Madison, Wisconsin 53706

Jay Janecek, DNR
1201 E. Hwy 2
Grand Rapids, MN 55744

Cindy Johnson, OMNR
99 Wellesley St. W., Room 2320
Toronto, Ont. M7A 1W3

Leon Johnson, DNR
1201 E. Hwy. 2
Grand Rapids, MN 55744

George Kolenosky, OMNR
P.O. Box 50
Maple, Ontario L0J 1E0

Anne Lambert, OMNR
P.O. Box 50
Maple, Ontario L0J 1E0

Ed Langenau, DNR
Wildl. Div., Box 30028
Lansing, MI 48909

Mark Lenarz, DNR
1201 E. Hwy. 2
Grand Rapids, MN 55744

Tim Lewis, Univ. of Wisconsin
226 Russell Labs, 1630 Linden Dr
Madison, Wisconsin 53706

Wayne Lintack, OMNR
Huronia District Office
Midhurst, Ont. L0L 1X0

Mike Malhiot, OMNR
R.R. #5
Wingham, Ontario N0G 2W0

Ken Maronets, OMNR
R.R. #5
Wingham, Ontario N0G 2W0

Dale McCullough, Univ. of Calif.
145 Mulford Hall
Berkeley, CA 94720

Fiona McKay, OMNR
P.O. Box 50
Maple, Ontario L0J 1E0

Rob Naplin, DNR
Area Wildl. Mgr., P.O. Box 271
Park Rapids, MN 56470

Marie Nietfeld, OMNR
P.O. Box 50
Maple, Ontario L0J 1E0

Dave Pauly, DNR
Wildl. Habitat Spec., Box 398
Hinckley, MN 55037

Peter Purych, OMNR
P.O. Box 190, 62 Queen St.
Blind River, Ont. P0R 1B0

Dave Reid, OMNR
P.O. Box 706, Hwy 3
548 Queensway W
Simcoe, Ontario N3Y 4T2

Os Schmitz, Univ. of Michigan
School of Natural Resources
Ann Arbor, Michigan 48109-1115

Peter Smith, OMNR
P.O. Box 50
Maple, Ontario L0J 1E0

Mike Steeves, OMNR
P.O. Box 50
Maple, Ontario L0J 1E0

Ray Stefanski, OMNR
99 Wellesley St. W., Room 2320
Toronto, Ontario M7A 1W3

Paddy Stiller, OMNR
North Bay District
P.O. Box 208, Powassan, Ont. P0H 1Z0

Midge Strickland, OMNR
Parry Sound Field Office
7 Bay St
Parry Sound, Ont. P2A 1S4

Bruce Ranta, OMNR
P.O. Box 5080, 808 Robertson St.
Kenora, Ont. P9N 3X9

Marilyn Twiss, OMNR
Box 3070, R.R. 3, Hwy 63
North Bay, Ont. P1B 8K7

Dennis Voigt, OMNR
P.O. Box 50
Maple, Ontario L0J 1E0

Mike Wilton, OMNR
P.O. Box 9000, Brndale Sq.
Huntsville, Ont. P0A 1K0

Dwight Wilcox,
White Earth Reservation
Box 418
White Earth, MN 56591

Roger Wolfe, OMNR
Box 3070, R.R. 3, Hwy 63
North Bay, Ont. P1B 8K7

Jim Ziegler
White Earth Reservation
Box 418
White Earth, MN 56591