STATE OF MINNESOTA
DEPARTMENT OF NATURAL RESOURCES

PHONE NO. FILE NO.

Date: 19 October 1992

To: Great Lakes Deer Group Meeting Participants

From: Glenn D. DelGiudice (218) 327-4432

PROCEEDINGS
OF
THE 1992 GREAT LAKES DEER GROUP MEETING

(Long Lake Conservation Center Palisade, Minnesota)
(September 8-11th)

I would like to take this opportunity to thank all of those who attended and participated in this year's Great Lakes Deer Group Meeting. Additionally, on behalf of all of those who attended the meeting, I extend our appreciation to all of those who made presentations to the group. The diversity of the speakers' backgrounds and the array of deer management and research-related topics, including applications of geographic information systems, winter habitat and migration research, statistical versus biological/ecological significance, urban and farmland deer management issues, GEIS, ecosystem management, supplemental feeding, hunting with the disabled, and others, stimulated interesting and useful exchanges and discussions. We extend special thanks to Bill Berg as well for his thorough presentation concerning the status of the wolf population in Minnesota.

Attendees also appreciated the deer population and habitat status reports provided by Ed Langenau, Mark Lenarz, Keith McCaffery, and Dave Schad.

And last, but certainly not least, we are grateful to Dr. Paul R. Krausman from the University of Arizona, for coming to our meeting at his own expense, and sharing his very interesting and unique insights of the habitat requirements of desert mule deer (and related management issues), and hopefully by so doing, broadening our understanding and appreciation of deer biological requirements and the plasticity of the relationship between deer and their habitat. Dr. Krausman's recent experience as an Associate Editor and Editor in Chief of the Journal of Wildlife Management, made his second talk concerning this journal and the Wildlife Society Bulletin and the purposes they are meant to serve, equally as informative and interesting.

Below, in the order they were presented, are brief summaries of the presentations. Status reports and updates are not included since handouts were available at the meeting.

DAVE SCHAD
MINNESOTA DEPARTMENT OF NATURAL RESOURCES

MINNESOTA HABITAT SUMMARY

Forest deer management in Minnesota has gradually evolved from a strong emphasis on direct development of deer habitat such as construction of forest openings and winter browse shearing, towards additional efforts to evaluate habitat and coordinate with forest land managers. This is partly due to a reduction in available funds, but more the result of changing resource needs and priorities. While coordination with forestry staff has always been an important activity in the Section of Wildlife, recent and planned increases in timber harvests, along with more awareness of the negative impacts that high deer populations and/or some deer habitat management activities may have on other forest wildlife species has created more of a demand for evaluation and coordination activities, and a general deemphasis in habitat development work.

Several ongoing projects in Minnesota reflect these changes, and are the subject of talks during this meeting. The Timber Harvest and Forest Management Generic Environmental Impact Statement (GEIS) being coordinated by the Minnesota Environmental Quality Board is an effort to evaluate the impacts of expected increases in timber harvests on all forest resources, including wildlife and biodiversity. The final GEIS will include recommendations on program, policy, and legislative changes necessary to avoid or mitigate these impacts. Enhanced habitat evaluation processes and coordination among resource managers and the general public are likely to be recommended.

The Deer Management Information System (DMIS) project is a second effort to better evaluate the consequences of management activities, and to prepare sound deer habitat evaluations and population management decisions. DMIS is funded by an appropriation from the Deer Habitat Improvement Fund that results from a $2 surcharge on the sale of each deer license. Those databases that are necessary to manage deer populations and habitats are being obtained or created, and incorporated into a Geographic Information System for use by area, regional, and St. Paul staff. The DMIS is expected to improve the ability of wildlife managers to make deer management decisions and provide input and recommendations to other land managers.

Development and maintenance of forest openings has generally been a high priority activity for forest deer managers in the past 20 years. However, there has never been an effort to inventory and evaluate Minnesota's openings resources. A forest opening inventory is currently being planned that will collect data on opening location, land administration, development and maintenance history, vegetation composition (where available), and any

management restrictions. Until this inventory is completed, funding for construction and development of new openings is generally being deemphasized. However, an effort will continue to be made to maintain those openings where an investment has already been made. It is hoped that the results of the openings inventory will allow for future evaluations of opening development and maintenance needs on a landscape basis.

STEVE BENSON
MINNESOTA DEPARTMENT OF NATURAL RESOURCES

DEER MANAGEMENT INFORMATION SYSTEM APPLICATION OF GIS

Minnesota DNR Wildlife's Deer Management Information System (DMIS) is a system for wildlife managers to assist in inventorying, analyzing, managing and monitoring deer habitats and populations. It's a two year project, funded with $350,000 from deer habitat improvement funds.

The goals are to pull together spatial data from a large number of sources to allow managers to analyze, display and map spatial habitat and population data, and to develop informed and biologically sound management decisions and recommendations.

A user needs assessment was completed, consisting of survey forms, interviews and meetings. A model of deer management information use was developed from this. A priority list of information needs was created, which centered on habitat assessment and evaluation. Then a strategy was produced to address the critical information needs.

A data assessment was completed and used to determine what data exists, to decide which existing data can be used and which data needs to be gathered.

The implementation strategy is to assemble habitat information into GIS coverages, including a vegetation layer, land use information, ownership and the National Wetlands Inventory. The project will also begin building DNR Wildlife spatial databases including deer kill blocks, Wildlife Work Areas, wildlife openings, a facilities inventory, wintering areas, improvements, habitat projects and Natural Heritage elements. Additional data will be imported from other agencies.

Hardware and software have been purchased, and tests on databases and software are underway. Applications will be developed for wildlife managers, training will be provided, and the system and data will be distributed.

The organizational issues that need to be handled are hardware, software and data costs, education, data distribution and the

changes in how habitat and populations are viewed, analyzed and modeled.

MICHAEL A. KILGORE
MINNESOTA ENVIRONMENTAL QUALITY BOARD

MINNESOTA'S TIMBER HARVESTING GEIS: ASSESSING TIMBER HARVESTING IMPACTS ON WILDLIFE

In Minnesota, recent forest products industry expansions and expectations for significant future development have raised concern over the potential environmental impacts associated with timber harvesting. Responding to this concern, The Minnesota Environmental Quality Board (EQB) commissioned a Generic Environmental Impact Statement (GEIS) to identify and assess the environmental consequences of timber harvesting at both current as well as potential future (higher) harvest levels.

Administered under Minnesota's Environmental Review Program, a GEIS focuses on assessing the cumulative impacts associated with a number of separate, yet related activities. In this study, cumulative impacts refer to those associated with the hundreds of individual logging activities occurring across the state each year. The three basic objectives of the Timber Harvesting GEIS are to: 1) identify long-term sustainable levels of timber harvesting; 2) identify and assess the environmental consequences of timber harvesting; and 3) develop ways of mitigating those environmental impacts considered significant. Impacts are assessed on a statewide and ecoregion basis at both present as well as more intensive levels of timber harvesting activity.

The GEIS analyzes a number of diverse issues associated with accelerated logging activity in Minnesota. One in particular is assessing the impacts timber harvesting has on wildlife populations, including large mammals such as the white-tail deer. Using changes in wildlife habitat as a proxy for assessing changes in the relative health of wildlife populations, assessments were made to determine the impact timber harvesting has on wildlife habitat. In making these assessments, both stand-level habitat structure (e.g., stand juxtaposition, snag retention) and landscape-level changes in forest cover patterns (e.g., age class structure, forest cover-type mix) were considered. Additionally, critical habitat requirements as well as existing policies of land management agencies were incorporated into the analysis.

While the results of the impact assessment are not yet available, study results will undoubtedly show that timber impacts the habitat availability of Minnesota's wildlife. At the individual species or species-group level, certain habitats are likely to be enhanced as a result of logging, whereas others will likely be reduced. Where

wildlife habitat is projected to be significantly reduced, the GEIS will develop strategies to help mitigate those impacts.

A draft Timber Harvesting GEIS should be available in 1993, at which time public input will be sought. A final GEIS is expected to be submitted to the EQB for approval in summer 1993.

GLENN D. DELGIUDICE
MINNESOTA DEPARTMENT OF NATURAL RESOURCES

ASSESSING THE RELATIONSHIP BETWEEN CONIFER STANDS AS WINTER THERMAL COVER AND MOVEMENTS, DISTRIBUTION, AND SURVIVAL OF WHITE-TAILED DEER IN NORTH CENTRAL MINNESOTA: A STATUS REPORT

In Minnesota, there is an ever increasing demand for wood products and a decreasing supply of hardwoods. In the past, land management agencies have considered conifer stands, particularly those of northern white cedar and balsam fir, to be "critical" winter habitat for white-tailed deer, and as a result, harvesting of these stands has been restricted. Anticipating increasing pressure from commercial loggers and the wood industry to permit greater harvesting of conifer stands in the future, the Department of Natural Resources has initiated a 10-year study to more closely examine the importance of conifer stands as winter thermal cover for white-tailed deer in Minnesota. I conducted a pilot study during winter, 1990-91 and committed to a full research effort during winter, 1991-92. This study takes a very comprehensive ecological approach to assessing the relationship between conifer stands and deer movements, distribution, and survival. This approach includes sequential assessments of deer movements, home range, use of habitat types, food habits, and physiological responses to nutritional deprivation related to changes in winter weather. Additionally, microclimates of the different habitat types, deer migrations, reproduction, and causes of mortality are being studied.

The study has included two study sites, one to serve as a 'control' site (Willow River) and the other as an experimental site (Inguadona Lake). An additional replicate of each has been selected and will be included in field operations for data collection this winter. Due to statistical and related financial and practical constraints, only does are being radio-collared for the study of movements, home range, migration, and habitat use.

After the 1991-92 winter field season, we had 39 does radio-collared on the two study sites. Mean age of collared does is 4.1 and 7.4 years on the Willow and Inguadona Lake sites, respectively. The mean number of days deer have been radio-collared is 261 and 356 days for Willow and Inguadona deer, respectively. Mortality of

radio-collared deer was 50.0% at Willow and 30.4% at Inguadona during 1991 and 28.6 and 3.6%, respectively, by July 1992. Causes of mortality included wolf predation, car accidents, hunter harvest, capture-related, "other" accident, and undetermined. This year, mortality from wolf predation has been greater on the Willow site. Details of cause-specific mortality were presented and discussed.

During spring 1991, 87% of the collared deer migrated; 13% did not migrate. During fall 1991, 59% of the deer migrated to winter range; 41% did not migrate. During spring 1992, 77% of the deer migrated, and 23% remained on winter ranges.

Distribution of seasonal migration distances, browse availability and use data, and details of schedules and protocols for collection of the various data were also presented and discussed.

BILL BERG
MINNESOTA DEPARTMENT OF NATURAL RESOURCES

UPDATE ON THE STATUS OF MINNESOTA'S WOLF POPULATION

Wolves once ranged throughout Minnesota, but by the early 1900's were exterminated from the southern one-half of the state. This reduction continued, and by the early 1950's 600-800 wolves resided in 31,000 km^2 of primary range in the extreme north. In 1965, when bounties were eliminated, wolves numbered 350-700. Since 1974, when wolves were completely protected in Minnesota, populations have steadily increased. A 1978-79 survey estimated the wolf population at 1,235, and a repeat of that survey in 1988-89 indicated that 1,550-1,750 wolves were present in about 250 packs which ranged over 66,400 km^2 of existing and potential range. The annual finite rate of increase has been 1.05 since 1970.

The diverse predator population in the northern deer range is responsible for more than 110,000 deer deaths annually, with black bears, coyotes, and wolves taking 90% of this total. Nearly all are <1 year old; wolves kill the highest proportion of adult deer (66%; about 21,000 annually). In recent deer hunting seasons, deer hunters have registered about 80,000 deer in the northern Deer Management Units, and wolves have taken about 31,000 deer in the same area.

The 1992 Eastern Timber Wolf Recovery Plan sets a goal of 1,251-1,400 wolves for Minnesota by Year 2000. Minnesota was 10%-40% above that goal in 1988-89, and wolf range and depredation numbers have increased since then. Once a second viable population has been established at 100 wolves in Wisconsin and Michigan for 5 consecutive years, the eastern timber wolf population will no longer be classed as Endangered/Threatened, and will be "recovered" in the lower 48 states. With the Wisconsin and Michigan wolf

population increasing at approximately 20% per year, the second viable population may reach its goal by 1994-1995.

ED LANGENAU
MICHIGAN DEPARTMENT OF NATURAL RESOURCES

DEER YARD MANAGEMENT IN MICHIGAN

Michigan's Deer Range Improvement Program emphasized upland cuttings when first established in 1972. At that time, there was an over-abundance of older aspen and a shortage of forest openings. Aspen stands were converting to northern hardwoods. With an improved timber market 20 years later, most state forests are now at or above goals for the habitat guidelines for deer (e.g. 65% preferred types, 6-12% forest openings, etc.). Increasing winter losses of deer during the 1980's suggested a need to evaluate the condition of winter deer yards, which have previously been de-emphasized in our Program. Since it has been difficult in some cases to get cedar to regenerate after cutting, policies on both state and federal lands have been to leave cedar and hemlock stands alone.

As a result of these state and federal policies, the prices of cedar sold on private lands have increased. Both industrial and private non-industrial forest landowners have been liquidating cedar on private lands. Even though only 25% of the cedar growth is harvested each year across the state on private lands in the eastern end of the Upper Peninsula, the rate of harvest has exceeded growth. The removal of cedar in a very large deer yard (325 square miles) and the subsequent loss of 25,000 deer during the winter brought this situation to a head. A lowland conifer initiative was developed as an add-on to the Deer Range Improvement Program in 1990.

The first step in developing this initiative was to evaluate the current knowledge and issue in cedar management through a workshop held in Saulte Ste. Marie in the winter of 1990. About 200 people attended the workshop, which involved small-group brainstorming by hunters, wildlife biologists, foresters, fire managers, agency administrators, corporate landowners, and private non-industrial landowners. (Proceedings were distributed at the 1992 Great Lakes Deer Group Meeting).

This Cedar Conference concluded that action was needed to (1) develop a clearing-house for information on technical research and ongoing management projects, (2) shift or add funds for on-the-ground projects to apply Verme and Johnson's successful method of regenerating cedar, and (3) research the relative impacts of silviculture and deer in regeneration failure.

Since the conference, we have pursued all 3 of these recommendations. Dr. Ray Miller of Michigan State University's Tree Improvement Center, now chairs a Cedar Action Group that is comprised of representatives from the U.S. Forest Service, Michigan DNR, Corporate landowners, and UP Whitetails, a hunting organization. This group is collecting technical papers on cedar and also keeping track of on-going field projects. During the summer of 1992, this group participated in a tour of deeryards and a discussion of cedar management issues for the Michigan Natural Resources Commission.

The Deer Range Improvement Program has been modified to include a line-item appropriation to field districts for lowland conifer regeneration. Districts were asked to locate deer yards that had high levels of traditional use, but where deer were now absent or at low levels. Project proposals were then developed to regenerate lowland conifers in these yards. The list of sites was prioritized by the Regional Wildlife Supervisor and projects were funded accordingly. In 1990/91, there were 722 acres where lowland conifer regeneration was attempted. Some of these projects involved fencing, bucket-mounding or other scarification techniques, liming, prescribed burning, and drainage.

Several proposals for research studies have been developed, although these studies cannot be funded with Deer Range Improvement Funds. Thus, we have been somewhat slower in getting any research projects on line within the state. The Hiawatha National Forest has undertaken a radio-collaring study of deer in the Stonington Peninsula and in the Whitefish River Deer Yard. Michigan State University is beginning a study of containerized seedling survival.

A follow-up Conference on Cedar is being considered for 1995. Perhaps this should be a Regional meeting involving several Great Lake's and Northeast states and provinces.

Individuals who would like to stay informed about the progress of the Cedar Action Group can be placed on the mailing list of a newsletter by calling or writing Dr. Ray Miller at (906) 786-1575 or J Road, Escanaba MI 49829.

ED LANGENAU
MICHIGAN DEPARTMENT OF NATURAL RESOURCES

HABITAT IMPROVEMENT

The Deer Range Improvement Program was initiated in 1972 through an earmarking of $1.50 from each deer license in the state. In the early years of the program, much work was done directly by Wildlife Division employees. We purchased D-7's, rolling choppers, skidders and other equipment and hired individuals to work in the woods. Sometimes, where the timber market was weak, we did non-commercial

cuttings to improve the habitat for deer.

As the timber market improved, more time was spent in working with foresters to help plan commercial sales so that deer and other wildlife values were considered. Now, we are spending most of our funds on salaries and wages to allow biologists and technicians adequate time to work with foresters on compartment reviews. We also are contracting work to local jobbers rather than employing so many equipment operators, laborers and farmers on our direct payrolls.

During the October 1, 1990 to September 30, 1991 fiscal year, accomplishments for the Deer Range Improvement Program included the following:

1,548	acres of herbaceous plantings
1,496	acres of non-commercial cuttings
42,151	acres of commercial forest cuttings
381	acres of new forest openings
3,356	acres of maintenance in old forest openings
722	acres of attempted lowland conifer regeneration
516,573	acres of cooperative planning for future logging and opening creation/maintenance

DALE E. KATSMA
WISCONSIN DEPARTMENT OF NATURAL RESOURCES

URBAN DEER MANAGEMENT IN WISCONSIN

Like many other metropolitan areas in North American, Wisconsin is experiencing problems associated with burgeoning deer populations and urban sprawl. The concerns and controversies are also similar: damage to vegetation, deer-vehicular collisions, disease concerns, and no easy acceptable solutions. Urban deer management in Wisconsin has, until recently, consisted of providing advice to homeowners on damage abatement and issuing deer removal permits.

There has been an active removal program at the University of Wisconsin Arboretum in Madison since 1958. This has been conducted primarily by University personnel with WDNR selling the deer to the public. Since the mid-1980's, about 30 deer per year have been removed from the 1,260-acre arboretum.

In the Milwaukee Metro area, the Schlitz Audubon Center began relocating deer in 1981. Initially deer were tranquilized for relocation. Box traps (Stephenson) have proven more efficient and are currently being used. Through 1990-91, 104 deer were relocated from this 185 acre private nature center. During the winter of 1991-92, 33 deer were trapped and sold to a private deer farm.

The Village of River Hills in Milwaukee County began a trap and relocate program in 1987. Until last winter deer had been relocated to the "wild" (a total of 348 through 1990-91). Last year 75 deer were caught in this 5.3 square mile village and sold to a private deer farm.

There are several other communities throughout the state that have growing deer herds in suburban areas. Several of these are in the Milwaukee Metro area with others around Madison, LaCrosse, Green Bay, etc.

During 1991, efforts related to deer management were made on several fronts. A WDNR Urban Deer Committee provided a prioritized list of recommendations for controlling urban deer populations (recreational public hunting, special deer hunts, controlled shooting by marksmen, live capture). Disposition of deer from live capture programs would be restricted to killing the deer and donation of the meat to charities or sale of live deer to private deer farms.

An Ad Hoc Deer Study Committee that was appointed by the Natural Resources Board in 1991 provided a list of 23 recommendations related to deer management in Wisconsin, including one related to urban deer. They recommended lethal control methods and banning translocation.

Also, a statewide review of deer management units and population goals was conducted in 1991. During this process, special management units were proposed for several metropolitan areas (Milwaukee, Madison, LaCrosse). These metro units passed the rule-making process, with some modifications, and will be in effect for the first time this fall. They allow liberal bag limits of 4 deer for both archery and gun seasons with only 1 antlered deer per season. In the Milwaukee Metro Unit the gun season is extended 2 weeks and overlaps the 7-day muzzleloader and late-bow season.

The current deer removal programs have been successful in controlling deer populations. A research project of resident and translocated deer from River Hills again documented low survival of translocated deer. These findings, high deer populations throughout the state, and the expense associated with translocation programs makes the case for other alternatives to controlling deer populations in urban areas of Wisconsin.

JON PARKER
MINNESOTA DEPARTMENT OF NATURAL RESOURCES

URBAN DEER MANAGEMENT IN MINNESOTA

This is a progress report on recent urban deer management programs in Minnesota.

Policy: MN DNR has a policy stated in an Urban Deer Management Plan which defines its role as a facilitator to local governments in deer management. In communities which have ordinances which prohibit shooting, thus hunting, DNR maintains that deer population management goals and methods should be determined and funded by those communities. Other policies make trapping and translocating of deer very difficult.

Deer Management Task Force: A task force of hunters, animal protectionists, and other interested groups was convened in 1989 and made recommendations for deer management on state and federal lands in the lower Minnesota River Valley. These recommendations have formed a basis for discussions with cities with deer problems. The second annual Task Force meeting last April was held with little dissention over ongoing hunting and sharpshooting programs by the State, USFWS, City of Bloomington, and Hennepin County Parks. The primary issue was a perceived delay by the State in advocacy and participation in research in immuno-contraception.

Deer Population Control: The City of Bloomington and Hennepin County Parks jointly instituted a sharpshooting program in Bloomington. Police officers and Park Rangers shot 285 deer. Bloomington Police performed well under DNR guidelines. There was very little public opposition to the program and no actual or perceived safety concerns during the shooting. Both agencies are preparing to shoot again this year; DNR has recommended increased removal goals. Management in other cities is briefly discussed.

Research: Jay McAninch proposed an intensive study of deer movements and behavior, density, distribution and productivity and mortality rates in the developed Twin Cities metro area. This project would also examine current control and damage abatement efforts, evaluate impacts of management, and develop control options. The study was not funded by the Legislature.

BRIAN S. HAROLDSON
MINNESOTA DEPARTMENT OF NATURAL RESOURCES

LOCALIZED WHITE-TAILED DEER POPULATION MANAGEMENT ON AGRICULTURAL LANDS IN MINNESOTA

Killing of antlerless deer during the hunting seasons is the primary means used to manage white-tailed deer populations at

levels which keep crop damage on agricultural lands at (or below) tolerable levels. In fruit orchard areas of southeastern Minnesota, late-season special hunts and emergency, out-of-season shooting permits have been used, in addition to the usual hunting seasons, in an unsuccessful attempt to reduce damage problems. A new, 3-year approach being tested is the allocation of bonus, antlerless-only permits on a sub-quota area basis. The permits allow hunters to kill a second deer, which must be antlerless and taken within the boundaries of the subarea. The objective is to reduce the breeding population in the sub-quota area by 4 deer/mi^2 while maintaining the current breeding population goal in the surrounding quota area, without degrading the quality of current hunting opportunities. Personal interviews and mail surveys of landowners were utilized to collect baseline data and determine program impacts. Results are reported for 1991 only. Landowners were pooled by land-use group: non-farmers; fruit farmers; and "other" farmers. Fruit growers experienced greater economic losses and a higher incidence of damage from deer than did the other land use groups. They also had the most liberal hunter access policy. Non-farmers reported the lowest mean economic loss and damage frequency and were most restrictive in hunter access. In general, landowners with deer damage were less restrictive in hunter access and more dissatisfied with the season than landowners with no deer damage. Also, landowners with unacceptable damage allowed greater access than did landowners with acceptable damage. Approximately 50% of all landowners residing within the sub-quota area do not hunt. Of those that do hunt, 50% prefer to hunt only bucks and/or feel that removal of additional antlerless deer is unnecessary. Permits were not purchased by other landowners because they were either unaware of permit availability or thought they were too expensive. To improve the implementation of the subarea permit program in 1992, we recommend: 1) landowners need to be instructed on wildlife damage control techniques, especially the importance of removing antlerless deer; 2) permits should be available locally (bait & tackle shops, sporting goods stores, etc.) as well as through the County Auditor; and 3) bonus and subarea permit prices should be reduced or eliminated. At the time of this writing, recommendations 2 and 3 have been implemented: permits will be available locally and at reduced cost. Subarea permit application rates by hunters should improve considerably in 1992.

PAUL STRONG
U.S. FOREST SERVICE

ECOSYSTEM MANAGEMENT AND WHITE-TAILED DEER OF THE CHIPPEWA NATIONAL FOREST

In 1986, the CNF released its first comprehensive land management plan. The Forest Plan emphasizes maximum beta or between stand diversity. The most common activity on the Forest affecting white-tailed deer habitat is clearcutting of aspen stands, many of which

have reached or passed silvicultural maturity. Most of the harvest units of all types are 10-40 acres. Forest Plan standards and guidelines restrict harvest of adjacent units until the cutover area has reached a height equal or greater than 20 percent of the height of the adjacent stand (7-8 years for aspen).

Another management activity designed to improve deer habitat is creation and maintenance of grassy openings. During the last 30 years, the Forest has created 5,421 acres of openings, maintained 9,922 acres of openings, and sheared 4,866 acres of lowland shrubs near known deer wintering areas.

Deer densities on the Forest have been estimated based on pellet counts and more recently on a harvest model. Densities have increased from 16 per square mile in 1984 to 31 per square mile in 1992. The total number of deer on the Forest based on this density and the size of the Forest is 73,000.

The Chief of the Forest Service proclaimed in early June that the Forest Service would adopt an ecosystem management philosophy and that it would rely less on clearcutting as a silvicultural tool. What this means for the Chippewa National Forest and white-tailed deer habitat is unclear.

There will likely continue to be a shift away from single-species emphasis toward a community-level emphasis. There will be more partnerships and cooperative programs with State, County, private, and tribal agencies. There will continue to be a change away from domination by consumptive uses to a more equitable mix of consumptive and non-consumptive uses. There will likely be greater emphasis on forested communities which have a more natural flavor, that is, more uneven age stands in types like pine in which we typically manage on an even age basis and with little within stand diversity. Conifer plantations and other stands dominated by one species will be less common. There will continue to be added emphasis on natural regeneration of forests and more "natural" management processes such as fire in permanent openings in an attempt to address the idea that processes and functions are as important as structure and condition.

None of the changes that are likely to affect the vegetative composition of the Forest will happen until the Forest Plan is revised in 1996. At that time there will be serious discussions about increasing the amount of old growth and old forest and increasing the patch size of these types in some areas. There will likely be a discussion about the value of putting more permanent openings on the landscape. Stand sizes of harvest units will likely increase in range with more small and large cutting units.

None of these will have a significant effect on the WTD population on the Forest in the next two decades. The WTD population will likely be more affected by harvest level and climate. In the long

run, winter habitat will likely stay the same. Summer habitat will decrease, but will not disappear. All of this is speculative because of the uncertainty of the nature of the next Forest Plan which will guide management.

KEITH R. McCAFFERY
WISCONSIN DEPARTMENT OF NATURAL RESOURCES

ON CARRYING CAPACITY

Short-term carrying capacity is difficult to determine because of the vagaries of phenology and weather. Indeed, most efforts to estimate carrying capacity by field measurements of forage have been unsuccessful. However, long-term carrying capacity can be estimated and should be the basis for deer population goals in forested zones. In the long term, maximum carrying capacity (K) is determined by climate and habitat. Climate is normally characterized by a 30-year rolling average. Habitat changes are recognized by decades. Deer, themselves, are the ultimate integrator of all the environmental variables that affect their well-being. Antler development, breeding rates, and net recruitment are measurable indices to the well-being of deer. These indices can enable us to estimate where deer herds are in relation to K.

Maximum carrying capacity for northern Wisconsin has been recently estimated to average 26 deer/sq.mi. This estimate fits well with all we know about deer densities and forest types based on 3 decades of habitat research. Current overwinter goals average 18 deer/sq.mi. or about 70% of K. Most of these goals were initially set in 1962 based on empirical information and intuitive judgement. That these goals have withstood the test of time bears witness to the excellent ability of earlier biologists to appraise carrying capacity with limited quantitative data. With increased quantitative data, today's biologists should do even better.

MICHAEL E. NELSON
U.S. FISH & WILDLIFE SERVICE

DEER MIGRATION IN NORTHEASTERN MINNESOTA

The movements of 280 radio-collared deer in northeastern Minnesota (1975-1992) indicated that 86% (n=242) of deer migrated between traditional summer and winter home ranges (372 spring and 226 fall migrations) while 14% (n=38) were nonmigratory.

The following multiple regression analyses examined the relationships between deer response variables and the independent weather variables of mean daily temperature (F) per month and mean weekly snow depth (ft) per month: (1) mean November arrival on

winter range related to November temperature and snow depth, (2) mean December arrival on winter range related to December temperature and snow depth, (3) mean yarding duration related to December-April temperature and snow, (4) mean onset of spring migration related to December-April temperature and snow. Migration and winter yard arrival dates were analyzed in terms of Julian dates. Analyses included yearling and adult females only, except for spring migration onset, which also included both sexes of fawns of unradioed females.

Onset of fall migration for all deer ranged from August to March but most deer migrated in November (50%) and December (29%). Males and females migrated equally among months. Mean onsets of female migrations ranged from 17 November to 22 December and 95% confidence intervals were ± 9 - 29 days.

Only 32% of the variation in mean November arrival on winter range was explained by average weekly snow depth (R^2=0.32, 10 df, P=0.04); mean November temperature was not related to mean arrival date.

Thirty-three percent (57/174) of female deer migrated in response to the first decreasing temperatures and snowfall in early November. Temperature and snow effects could only be separated in 8 of 17 years.

In 6 years of little or no snow, 23% (12/53) of females first migrated when temperatures decreased to ≤ 20F for ≥ 4 consecutive days. Shorter periods with that temperature decrease elicited no migration response. In 1 of those years deer ignored a 0.8 ft. snowfall occurring 5 days prior to decreasing temperatures.

In 2 years of snowfalls with temperatures ≥ 20F, 11% (2/19) of deer migrated after 0.3 and 0.7 ft. snowfalls. However, 1 group of 3 deer returned to their summer range after a subsequent 1.0 ft. snowfall.

Forty-four percent of the variation in mean December arrival on winter range was explained by mean weekly snow depth with deeper snow associated with earlier arrivals (R^2=0.44, 10 df, P=0.02; Arrival date = 350 -6.8X; X = mean weekly snow depth). Mean temperature did not explain significant variation in mean arrival date.

A model of mean December snow depths and temperatures and mean April temperatures explained 86% of the variation in mean yarding duration (R^2=0.86, 15 df, P< 0.0001, Yarding duration = 192.0 + $17.7X_1 + X_2 - 2.5X_3$, where X_1 = mean December snow depth, X_2 = mean December temperatures, X_3 = mean April temperatures).

Onset of spring migration averaged 19 Mar. to 24 Apr. with 95% confidence intervals ± 1 -12 days. Mean weekly snow depths in

March and April and mean April temperatures explained 93% of the variation in mean onset date (R^2 = 0.93, 17 df, P< 0.0001, Mean onset = 134.6 + 4.9X_1 + 8.6X_2 - 1.3X_3, where X_1 = mean weekly snow depth in March, X_2 = mean weekly snow depth in April, X_3 = mean April temperatures. A disproportionate number of males migrated in May, averaging 37 days later than females.

Conclusions

Fall migration onset was highly variable but at least 33% of deer migrated with the first snowfall and temperatures ≤ 20 F in November and approximately 80% migrated before January. Mean yarding duration can be predicted from mean weekly snow depths in December and mean temperatures in December and April. Mean spring migration onset can be predicted from mean weekly snow depths in March and April and mean April temperatures.

MICHAEL RIGGS
MINNESOTA DEPARTMENT OF NATURAL RESOURCES

THE RELATIONSHIP BETWEEN STATISTICAL SIGNIFICANCE AND BIOLOGICAL/ECOLOGICAL SIGNIFICANCE IN WILDLIFE STUDIES

Results of wildlife studies frequently are accompanied by various test statistics (e.g., F or T test scores) and their corresponding "P-values". Sadly, it is not uncommon to see papers in which only the P-values are presented. Discussions and conclusions usually center on dichotomous inferences based on whether the P-values exceed some arbitrarily prespecified "alpha-level". In this paper I shall review the elements of a statistical test of hypotheses, particularly as they relate to power and to type I and II errors. The concept of a 1-α% confidence interval and its relationship to statistical tests with type I error probabilities set at α, also will be discussed. Next, an operational definition of biological significance will be established, based upon the observed magnitude of parameter differences. Finally, I shall compare the reliability of decisions regarding biological significance which are derived from statistical tests with those which are based on confidence intervals about estimated parameter differences. Application of these concepts will be demonstrated by considering the solution to a recent controversy in the wildlife management literature.

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"FOREST MACRO:" APPLICATIONS OF GIS IN THE COORDINATION OF FORESTRY/WILDLIFE HABITAT MANAGEMENT

The Forest Macro is a shell program using the EPPL7 GIS package to depict various habitat components suitable for various forest

wildlife species. Through slides, we will show some practical applications of GIS for deer habitat planning and coordination of practices with forest managers. Other habitat applications of GIS will be touched upon (sharp-tailed grouse, osprey, eagles, etc.). Computer generated GIS maps will also be on display for viewing and discussion.

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MINNESOTA DEER HUNTERS ASSOCIATION

The Minnesota Deer Hunters Association (MDHA) began as Save the Deer - an effort to help starving deer. It has three main areas of emphasis: education, legislation, and habitat. MDHA was founded to help deer and deer hunting in Minnesota.

Education:

-MDHA's education programs also help fund deer research programs in the state
-1991 was the first year for a scholarship program
-Forkhorn camps - sponsored in two locations in the state for youth to learn about archery and firearms safety and hunting technique as well as woods craft and wildlife management
-Deer Boxes - an on-loan kit which will contain 12 learning stations about deer, Lyme disease, urban deer and hunting, and include curriculum

Legislation: one of the most powerful sportsmen's lobbies in the state

-Second largest non-profit organization representing 20,000 hunters
-Through the use of a phone tree can activate political pressure on short notice

Habitat: Hides for Habitat Program

-All proceeds from hides sold are dedicated to habitat
-Last year's figures: 38,500 hides raised $102,000 for habitat
-Since 1985 83,000 hides have been collected which has netted $471,000 for deer habitat projects

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DEER HUNTING WITH THE DISABLED ON THE CARLOS AVERY WILDLIFE MANAGEMENT AREA

A limited deer hunt for the disabled was held at the Carlos Avery Wildlife Management Area (23,000 acre wildlife management unit located in Anoka and Chisago Counties just north of the Minneapolis-St. Paul metro area). Restrictions related to vehicle access and permanent stands were relaxed for this hunt. The hunt was held during the regular season framework. Weather proved to be a complication for the hunt.

In 1991 Minnesota State Legislature passed legislation, which was signed into law giving the Minnesota Department of Natural Resources authority to set special seasons, and to work with non-profit organizations to provide hunting opportunities for disabled individuals.

In the fall of 1991 a special hunt for the disabled was held at Carlos Avery under the authority provided to the DNR by the legislature. The staff at Carlos Avery worked with the North Suburban Chapter of the Minnesota Deer Hunters Association and another non-profit group, Capable Partners. The dates for the season were October 19 - October 27 (three weeks prior to firearm season). The hunt was held in the sanctuary portion of the wildlife area. Again, permanent stands and special vehicle access were allowed. Twelve disabled hunters harvested seven deer. The hunt received positive coverage from local media. A hunt similar to the 1991 hunt is being planned for 1992.

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STUDYING THE EFFECTS OF SUPPLEMENTAL FEEDING ON THE NATURAL FOOD HABITS OF FREE-RANGING WHITE-TAILED DEER AND ON STANDING BROWSE

The controversy "to feed or not to feed" wintering deer has been a public and political debate for decades. In recent years there has been a growing tendency for private citizens and sport clubs to supply artificial feed to wintering deer regardless of winter conditions. Such supplemental feeding must be studied to provide the necessary data for addressing issues related to ecological implications. This study was designed to examine the effects of supplemental feeding on the natural food habits of white-tailed deer and on standing browse. "Zones of influence" of feeders in forested habitat, browse availability and utilization by fed and unfed deer, dietary composition (via histological analyses of fecal pellets), and deer nutritional status (via chemical analyses of

urine voided in snow) will be sequentially monitored throughout two winters to accomplish the goals of this st udy.