Effects of Deer Herbivory on Birds

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INTRODUCTION

White-tailed deer (*Odocoileus virginianus)* is a dominant ungulate species native to Wisconsin and the forests of the eastern United States. Prior to European settlement, deer populations were significantly lower due to predation by species such as gray wolf *(Canis lupus)* and cougar *(Puma concolor)* in a landscape of extensive eastern deciduous forests that could not provide sufficient forage to support a large deer population. With the loss of these large predators and with Native Americans no longer hunting year-round for both sexes, deer populations increased. Changes in vegetative cover that have occurred since the cut-over period around the turn of the century also has significantly influenced deer numbers. Focusing wildlife management practices to directly benefit deer also had direct bearing on increasing the size of the state's deer herd. Hunting now acts as one of the primary factors limiting deer population sizes. Without some type of biological regulation, either through predation or hunting, deer populations can reach very high densities. Considering that hunting is losing popularity in Wisconsin, large predators remain extirpated in many locations of the state, and human-altered landscapes provide abundant food sources, deer populations have increased in Wisconsin by 600% since 1950 to an estimated 2006 population of 1.6 million. Fall deer densities in 2006 varied from fewer than 15 to more than 100 per square mile of suitable habitat. Deer management units with the highest fall densities are mostly in the east-central and southern parts of the state, whereas units with the lowest fall deer densities are mostly in north-central and northeastern Wisconsin **http://dnr.wi.gov/org/land/wildlife/HUNT/DEER/maps.htm**.

Aside from the lack of predators in most locations, deer also face little competition from other herbivores. Historically, deer competed for food and space with elk *(Cervus canadensis)*, caribou (*Rangifer tarandus*), woodland bison *(Bison bison athabascae)*, plains bison *(Bison bison bison)*, and moose *(Alces alces)*. However, without the presence of competition, the deer population can grow extremely fast due to the availability of forage. Such forage includes woody plants, nuts, fruits, and corn during the winter. With the loss of nearly all population regulating factors except hunting, there is an overabundance of white-tailed deer in eastern North America today. As a result, overabundance presents nearly as challenging of a conservation issue as the near absence of deer in the same landscape only 70 years earlier.

One primary conservation challenge faced by the overabundance of deer is their effect on the understory vegetation of forests. Specifically, deer eat many plants in the herbaceous layer of the forest floor, which limits recruitment of plants into the forest. In other words, deer are eating away the future plant generations, thus creating forests that are simply growing older. One repercussion of the removal of the forest understory

is on forest birds. Without ground cover, ground nesting birds have fewer places to nest. Similarly, without new plant generation, whole vertical habitat components of the forest are missing, which can limit habitat availability for a number of bird species.

High deer numbers have additional negative impacts. These include the high rate of deer-automobile accidents, the consumption of agricultural products and landscaping by deer, and the suppression of valuable timber species and wildlife food sources. While agricultural and timber damage is addressed on a case-by-case basis on private lands, ecological impacts are not given the same consideration.

"The earth's ecosystems are being modified in new ways and at faster rates than at any other time in their nearly 4 billion year history. These new and rapid changes present significant challenges to our ability to predict the inherently uncertain responses and behaviors of ecosystems." (Christensen, et al. 1996)

FACTS AND RESEARCH FINDINGS (SEE REFERENCE SECTION FOR SOURCES)

Populations of deer in protected areas (closed to hunting, no predation) are capable of causing significant shifts in the composition and abundance of bird communities. Increasing the density and diversity of understory vegetation can be brought about by reducing deer density.

In North Dakota grassland habitats, white-tailed deer ate songbird eggs and nestlings in both ground- and above-ground nests. Deer found and depredated both open bowl-type and covered-bowl nests.

By reducing the density of the shrubs and saplings, deer browsing can reduce vertical complexity in forest stands. As a result, a reduction in vertical complexity reduces the abundance and diversity of shrub-nesting birds and the densities of migrant birds.

In an American beech dominated forest in Pennsylvania with a high population of deer, correlations between breeding bird richness and several indicators of woody plant diversity (e.g., numbers of individual shrubs, tree and shrub level species richness, tree Shannon index) were positive and significant.

Deer herbivory can almost denude the forest floor completely of vegetation in some areas, which then removes nesting habitat for ground-nesting birds. Deer typically avoid foraging upon certain invasive species such as buckthorn (*Rhamnus* spp.), garlic mustard (*Alliaria petiiolata*), or honeysuckle (*Lonicera* spp.). Consequently, invasive species can out-compete native seedlings, leaving a forest understory that has been shown to result in a lower nesting success rate for low-level nesting birds.

Because deer forage selectively, they have the potential to strongly affect competitive relationships among plant species. By affecting competitive interactions among plants with varying levels of chemical defenses and by altering successional trajectories, deer

have the potential to alter ecosystems processes that include energy transfer, soil development, and nutrient and water recycling.

Deer can exert negative cascading effects on other animals both by competing directly for resources with other herbivores and by indirectly modifying the composition and physical structure of habitats. By modifying plant and animal species abundance and diversity, deer can modify trophic interaction (competition for available nutrients) among species.

Overabundant populations of white-tailed deer reduce forest regeneration, impact woody understories, eliminate many herbs, reduce plant diversity, and negatively impact habitats for songbirds.

Overabundant deer populations can also have negative impacts on public health and safety, which include tick-borne disease (i.e. Lyme disease) and vehicle collisions (e.g., > 600 people were injured and 12 people killed in Wisconsin in deer/vehicle collisions in 2005). The economic impacts of overabundant deer include increases in deer-vehicle accidents, negative effects on timber resources and ornamental and agricultural plantings. According to the Wisconsin Insurance Alliance, deer/vehicle collisions caused property damage totaling > $100,000,000 in 2006.

Using fenced enclosures with different deer densities in a hardwoods forest in Pennsylvania, deer densities > 3.1/sq mi reduced intermediate crown (0.5 – 7.5 m) nesting species richness and abundance apparently by reducing height of woody vegetation in the intermediate canopy on thinned and clear-cut sites.

In comparing differences in bird occurrence and abundance between an area in Pennsylvania affected by 27 years of deer over-browsing and an adjacent area with only 1/5 or 1/10 the deer density, ten species of ground-nesting or intermediate canopy-nesting birds were absent or occurred at lower frequencies in the area with higher deer density.

The number and diversity of the bird population may be reduced as deer populations rise from 15 to over 35 per square mile due to impacts on ground level vegetation, the shrub layer, and tree species composition.

The results of several enclosure and exclosure studies have linked the composition of forest bird communities to structural changes in forest habitat caused by high-density deer populations. In a study comparing enclosures with deer densities of 10, 20, 38, and 64 deer/sq mi in northwestern Pennsylvania where over-browsing was common, species richness of forest understory birds increased in the plots with the lowest deer density within 10 years.

In a study of breeding bird populations at eight sites in Virginia, 80 five-acre plots were established at each site; half were fenced and half remained unfenced. Vegetation measurements were made three times over a nine-year period; bird population data

were collected by mist netting annually in June. Deer density in the region was in excess of 10 deer/sq mi throughout the study. Fenced plots responded quickly to deer exclusion by developing increased density in the understory as the grasses that initially dominated the forest floor were replaced by brambles and tree saplings. By as little as one to two years into the study, bird species composition in the exclosures had shifted from birds such as the Chipping Sparrow (*Spizella passerine*) that prefer more open understory to Indigo Bunting (*Passerina cyanea*), Hooded Warbler (*Wilsonia citrina*) [http://www.dnr.state.wi.us/org/land/er/factsheets/birds/Hoowar.htm], and Ovenbird (*Seiurus aurocapilla*), all of which benefit from denser shrub and understory layers. Recovery may have been faster at these sites because they lacked the dense layer of hay-scented fern (*Dennstaedtia punctilobula*) and New York fern (*Thlypteris noveboracensis*)frequently present in stands subjected to canopy thinning and overbrowsing in Pennsylvania.

In a Virginia study, the diversity of birds did not increase significantly following exclosure of deer, primarily because of replacement of species as understory vegetation proceeded through successional processes. Changes in understory vegetation accounted for most of the variability seen in the abundance and diversity of bird populations.

RESEARCH NEEDS

Studies are needed to further quantify how birds that share habitats with deer respond to changes in deer density. These studies are needed to enable us to effectively plan management strategies for bird species whose populations have been declining over the same period that deer densities have been increasing.

Studies utilizing fenced deer exclosures in a variety of locations and deer habitat types in Wisconsin are needed to evaluate and quantify biota (habitat/animal and plant) responses in the absence of deer herbivory.

Comparisons of sites where predators have been reintroduced versus absent would provide a more complete picture of herbivory.

RECOMMENDED ACTIONS

The WDNR's deer management policies should give greater consideration to the impacts of deer on the state's other wildlife, including birds. Established and emerging science concerning the impact of deer on Wisconsin's varied ecosystems needs to be more fully incorporated into these policies to maintain and re-establish healthy ecosystems for all of Wisconsin's wildlife.

At this time the WDNR uses funding from hunter license sales and taxes on the sale of firearms and ammunition to manage Wisconsin's deer herd. Deer management should be funded by public money so that everyone with a stake in the future of forests and

wildlife in Wisconsin has a more meaningful say in deer management policies and shares responsibility for effective management.

Deer management must move beyond a population-based approach to an approach that considers whole-ecosystem effects. Encourage the quantification of the relationships between community composition across taxa (various species) and deer at various abundances to understand the full range of deer impacts on biodiversity.

Do not provide supplemental feed for deer. This practice has been shown to artificially congregate deer, which may lead to a more pronounced impact on the surrounding habitat.

Because overabundant deer can cause severe, long-term impacts that are difficult to reverse, we should urge for a reduction in deer numbers before and not after such impacts become evident. Although research results and active involvement by birders may not change attitudes quickly, they play crucial long-term roles in redirecting people's attitudes and patterns of management.

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revised September, 2010.