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David M. Kocka

Virginia Department of Game and Inland Fisheries, P.O. Box 996, Verona, VA

Frederick M. Garst

USDA Natural Resources Conservation Service

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THE USE OF GIS TO DELINEATE POTENTIAL URBAN DEER HABITAT

DAVID M. KOCKA, Virginia Department of Game and Inland Fisheries, P.O. Box 996, Verona, VA 24482

FREDERICK M. GARST, USDA Natural Resources Conservation Service, 1934 Deyerle Avenue, Suite A, Harrisonburg, VA 22801-3484

Abstract: Overabundant deer herds in urban environments often require new and creative approaches to properly evaluate the situation and gain support for population management. To determine potential white-tailed deer (*Odocoileus virginianus*) habitat for the Harrisonburg, Virginia, Deer Task Force, a geographic information systems (GIS) map was created that reflected current land use in the city. Data were compiled using 2m resolution Digital Ortho Quarter Quads. Using this backdrop, land use zones were digitized on-screen. Wooded (13%), Agricultural (20%), and Open Areas (14%) land use types accounted for nearly half the city's land area and represent a conservative estimate of the amount of available potential deer habitat. Management implications are discussed.

Key Words: deer, GIS, habitat, *Odocoileus virginianus*, overabundance, urban, Virginia

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One of the greatest management challenges faced by wildlife professionals today is that of overabundant deer herds, especially in urban environments. This problem is unlike most other issues faced by wildlife agencies because it is based on social values rather than biological science. This presents serious challenges to the creativity, integrity, and social skills of agencies' professional staff (Doig 1995). So great is this challenge that the Summer 1997 issue of the *Wildlife Society Bulletin* was devoted to this topic (Warren 1997), as were the proceedings from 2 recent symposia on deer overabundance (McAninch 1995, McShea 1997). Deer exist throughout the U.S. and 42 state wildlife agencies have identified at least 195 urban populations (Conover 1995).

Throughout Virginia, deer density has increased dramatically in the last 20 years (Knox 1997), and many of the Commonwealth's cities likely have had deer populations present for 10-30 years. Most complaints associated with urban deer populations have arisen since the 1980s (Conover 1995). The deer population in Harrisonburg, Virginia, remained relatively unchanged until the city annexed land in 1984 and later (1987) enacted an ordinance that prohibited the discharge

of weapons, thereby eliminating hunting from within city limits. Since that time, the deer herd has increased as evidenced by damage complaints and deer-vehicle collisions. A task force was appointed by City Council in May 1995 to assess concerns relative to deer in the City of Harrisonburg and to make recommendations to Council.

Current research needs relative to deer overabundance include efficient methods to estimate deer population size and forage abundance at specific landscape scales that range from habitat patches to deer home ranges (Healy et al. 1997). As a first step in this process, we used current geographic information systems (GIS) technology to create a map of land use in Harrisonburg and to estimate how much of the City could be classified as potential deer habitat.

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Service (USDA-NRCS).

STUDY AREA

Located in Rockingham County, Virginia, Harrisonburg lies on the floor of the Shenandoah Valley and straddles the Interstate 81 corridor. Harrisonburg is a city of 30,000 people and encompasses approximately 45 km².

METHODS

In 1990, the Rockingham County USDA-NRCS office became 1 of only 5 counties in the US to receive high resolution, panchromatic digital ortho-quarter quads (DOQ). DOQs consist of scanned photography flown at an altitude of approximately 12,200 m. The scanned product is combined with a digital elevation model and ground points to rectify the image, which produces an accurate digitizing base that meets national map accuracy standards. This technology eventually will be available nationwide as the US Geological Survey completes flights of all US land areas. Since 1990, 5 additional counties, several cities, and 1 watershed have been completed in Virginia.

Students from James Madison University's Geography Department were trained and worked in cooperation with USDA-NRCS and Virginia Department of Game and Inland Fisheries (VDGIF) personnel to digitize the map from on-screen imagery. The imagery scale was 2 ground meters per pixel. Land use was classified into the following categories: Wooded, Agricultural, Open Areas (included parks, ball fields, and schools), Residential A (adjacent to Wooded, Agricultural or Open Areas), Residential B (Urban), Water, and Dense Commercial. Once digitized, the map was reviewed for errors and all broken or unconnected lines were fixed. The image then was imported into GRASS MAPGEN, a map making utility, where fill patterns were selected and acreage values (%) were computed for all categories.

RESULTS AND DISCUSSION

The percentage of land area classified into each of the land use categories was as follows:

Wooded Area (13%), Agricultural (20%), Open Areas (14%), Residential A (17%), Residential B (30%), Water (<1%), and Dense Commercial (6%) (Figure 1). To produce a conservative estimate of the amount of available deer habitat, we combined the Wooded, Agricultural, and Open Areas categories, which accounted for 47% of the City's land area. We believe that >50% of the land area in Harrisonburg could be classified as deer habitat when Residential A lands are added. This becomes important given the fact that this type of potential deer habitat is located throughout Harrisonburg. Therefore, any management activity being contemplated should be evaluated on a city-wide basis rather than on just a portion of the City. The map we produced also serves as a tool to predict where urban deer conflicts might be expected to occur in the future, based on current conflicts and the corresponding land use categories where they now exist.

MANAGEMENT IMPLICATIONS

Land use maps derived from high resolution aerial photography represent an efficient means to delineate potential deer habitat in urban areas. These maps provide clues to where deer exist in an urban environment, thereby enhancing efforts to efficiently estimate population size and forage capabilities. Furthermore, they give the layperson, who often is involved in resolving urban deer conflicts, a visual image of the potential range of deer in a particular urban setting. When presented with such information on potential deer habitat and the range of available options to control urban deer, the Harrisonburg City Council ultimately approved a management program to control deer when damage occurs on agricultural lands within city limits.

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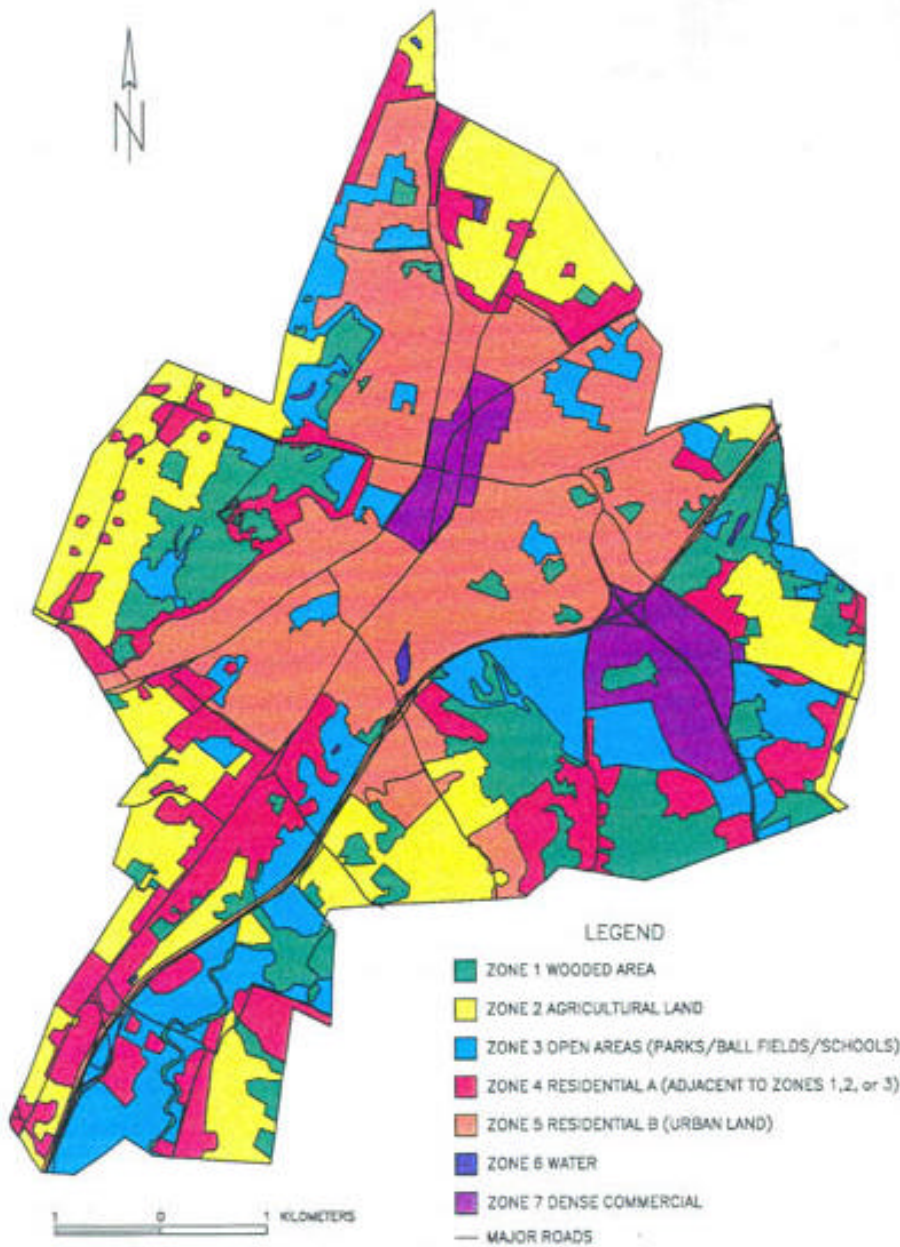


Figure 1. GIS map of land use used to estimate potential deer habitat for Harrisonburg, Virginia, created in August 1995 using 1990 Digital Ortho Quarter Quads. This map was produced at the Virginia Natural Resources Information Center-The USDA Natural Resources Conservation Service in Harrisonburg, VA. Zones were digitized on-screen with 1:12,000 Digital Ortho Photos (1990 flight). The digitizing was done by students in James Madison University's Department of Geography for the Virginia Department of Game and Inland Fisheries. County and city boundaries are "Tiger" 1:100,000 Vectors. UTM projection zone 17. A GRASS/MAPGEN interface was utilized with the production of this map on August 1, 1995.