

Effectiveness of State Regulations to Protect Deer Wintering Habitats in Maine:

Did the Designation of LURC-zoned Deeryards Achieve Desired Objectives during the Period 1975-2007?

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Primary Finding: Broad-scale conversion of mature forest to regenerating forest occurred during 1975-2007 in the areas surrounding DWAs protected via state regulations. Current stand and landscape conditions will likely not meet deer management objectives and expanded zoning would be extremely costly to landowners, with uncertain future benefits for deer and general forest biodiversity.

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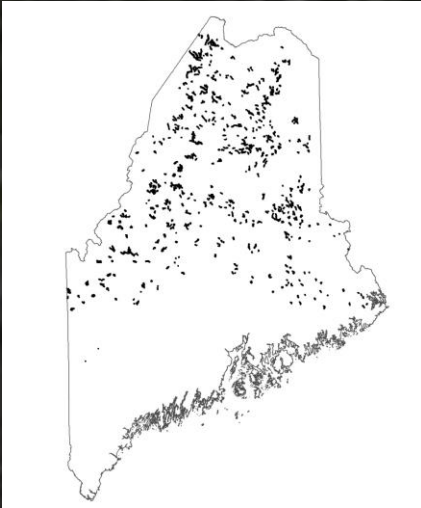
Project Summary



We evaluated the effectiveness of zoning to protect wintering habitat for white-tailed deer (*Odocoileus virginianus*) across commercially managed forestlands in northern Maine. Prior to our study, approximately 190,000 acres (2-3% of land area) of deer wintering areas (DWAs) across 981 management units had been formally protected via zoning by Maine's Land Use Regulation Commission (LURC). Our primary goal was to evaluate the effectiveness of those protections by evaluating harvest history and habitat change within zoned DWAs from 1975 – 2007 and by quantifying the extent of change in extent and fragmentation of mature conifer forest habitat within a 1.25 mile radius buffer around zoned DWAs by applying a time-series of satellite imagery across a 4.1 million acres study area. We also evaluated the potential for expanded future zoning of remnant large patches of mature conifer forest. Thus, we quantified potential costs in terms of altered land value and value of wood potentially affected by increasing zoning to ~10% of the landscape, as has been proposed by Maine's wildlife management agency. Finally, we evaluated the value of zoned DWAs as sites for conservation of a broader array of forest vertebrate biodiversity.

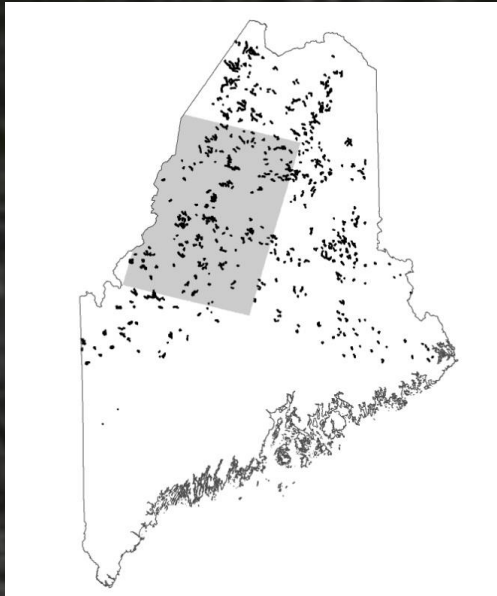
Our results indicated that nearly all DWA's had harvesting activity within their boundaries, that 91% had at least 1 heavy harvest area, and that 23% of the mature forest area within DWA's was harvested from 1975 – 2007. More importantly, the extent of mature conifer forest habitat declined and the fragmentation of remnant patches of deer wintering habitat increased substantially in areas within 1.25 miles of the boundary of zoned DWAs from 1975-2007. Further, in 2007, < 1% of the landscape was in remnant patches of mature conifer forest that were > 250 acres in area, and virtually all remaining patches of mature conifer forest > 12.5 acres in area would need to be protected to achieve a goal of 10% of the landscape in conserved DWAs. We estimated that additional zoning of those areas could result in decreased land values of \$160,000,000 and that the potential wood value on protected areas would total approximately \$457,000,000 to landowners. Finally, we concluded that existing deer wintering areas were relatively ineffective in conserving a broader array of forest vertebrate biodiversity, suggesting that alterations in deer management objectives, as well as new approaches to forest landscape and biodiversity conservation are needed in the Northern Forest region.

Background and Justification

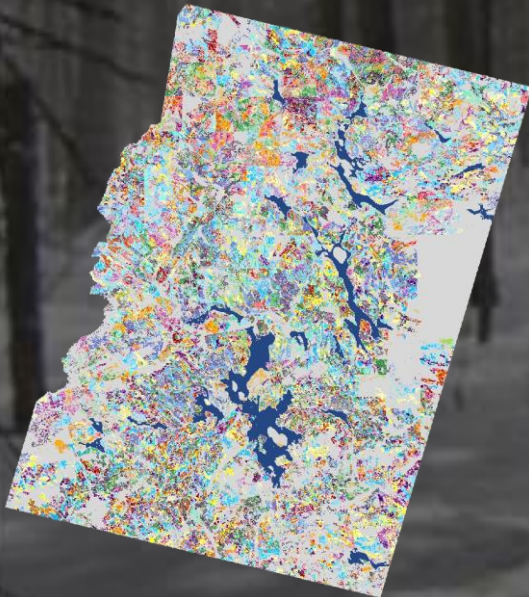


- ~190,000 acres within 981 deer wintering areas (DWAs) were zoned for white-tailed deer within unorganized townships of Maine.
- Despite those efforts, the state wildlife management agency estimates that quality wintering habitat in these areas has declined from ~10% to 5% of the landscape.
- Sportmen's organizations and state agencies have stated goals of increasing the extent of protected deer wintering areas in northern and western Maine to 8-10% of land base by 2030 (or sooner).
- The extent to which past zoning has been successful in protecting habitat within deer wintering areas is unknown.
- Further, the extent that landscape changes adjacent to DWA's have affected the ability of DWAs to serve as viable deer wintering habitats is uncertain.
- Currently, only 2-3% of the landbase is protected as DWA's within commercially managed forests in Maine. The costs to landowners, as well as potential benefits to broader wildlife biodiversity, of potentially expanding the extent of state-protected DWA's had not been studied.

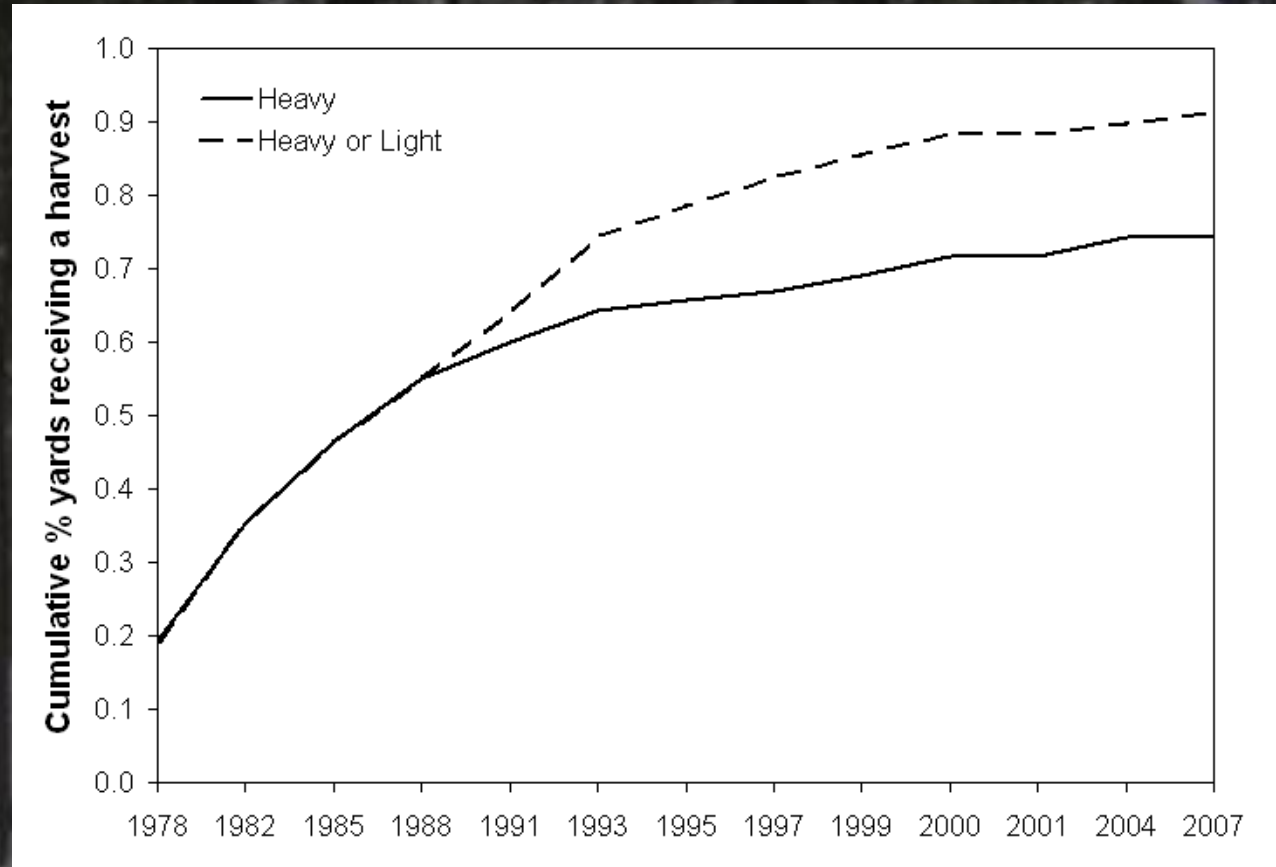
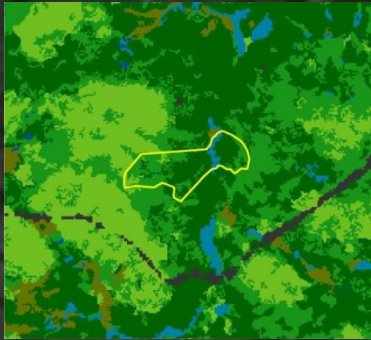
Methods



- We employed a time-series of satellite imagery from 1970-2007 across a 4.1 million acre area of northern Maine to document forest change and harvesting patterns within 58,560 acres of LURC-zoned DWAs.
- We quantified changes in landscape composition and fragmentation within a 1.25 mile radius around zoned DWA's during the period 1975-2007.
- We simulated the effects of increased zoning restrictions to meet the MDIFW objective of 8-10% of the land base in zoned yards and we evaluated potential losses in forest productivity and monetary costs to landowners.
- We evaluated how well existing DWAs function as habitats for conserving general forest biodiversity.

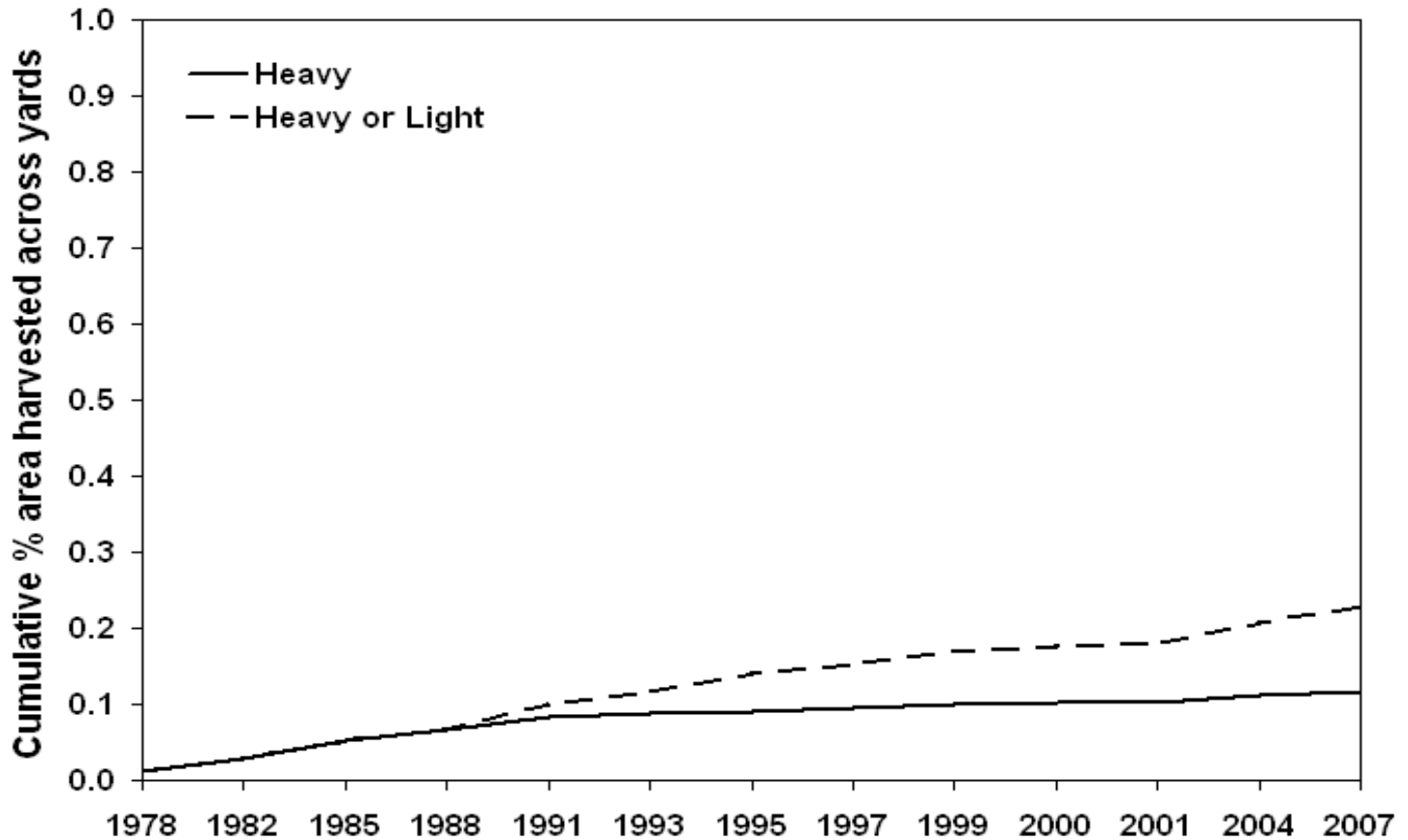
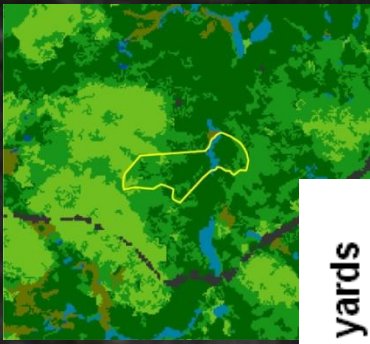


Result: forest harvesting was a common management practice within zoned DWA's



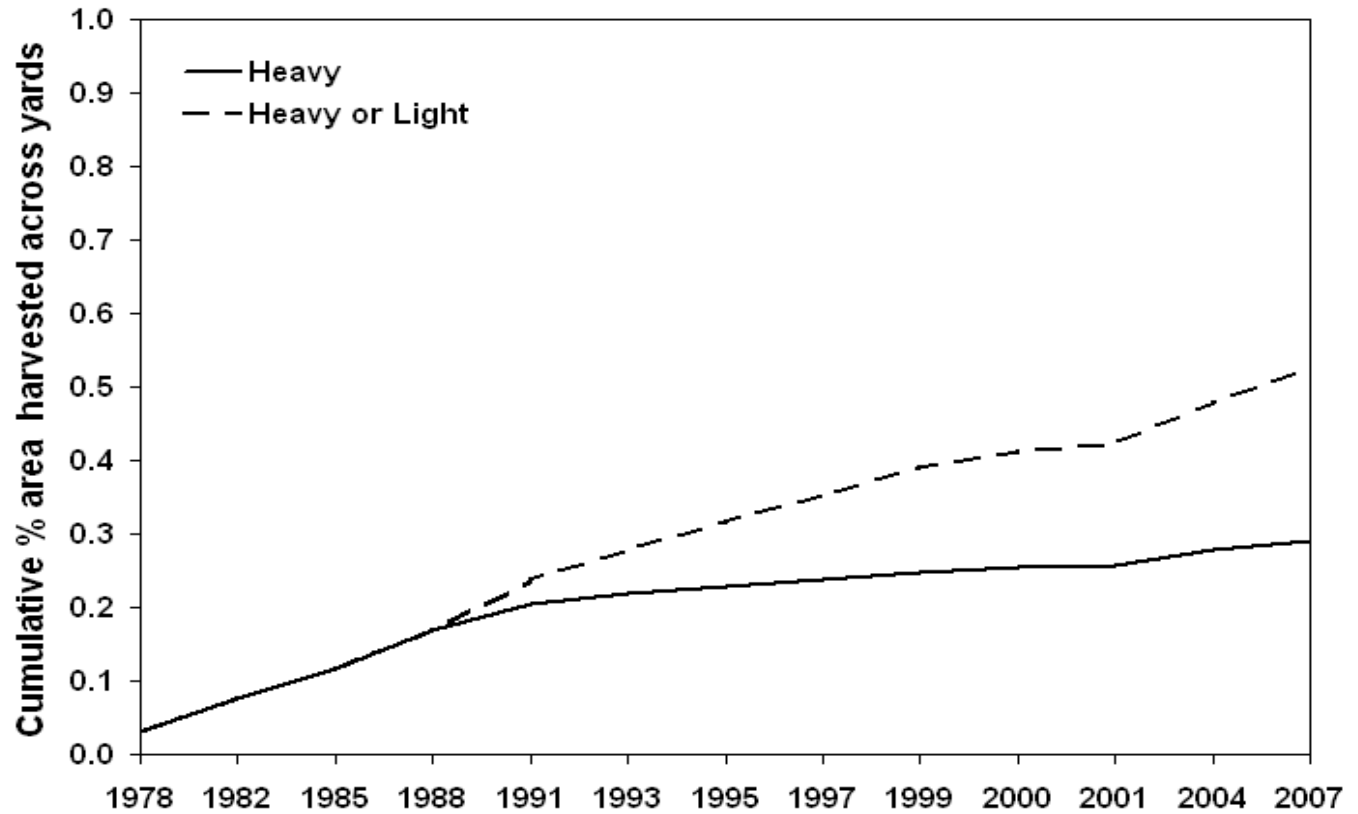
60% ($n=187$) of the DWA's received a heavy harvest by 1991.
Nearly all of the DWAs (91%) received a harvest 1975-2007.

Result



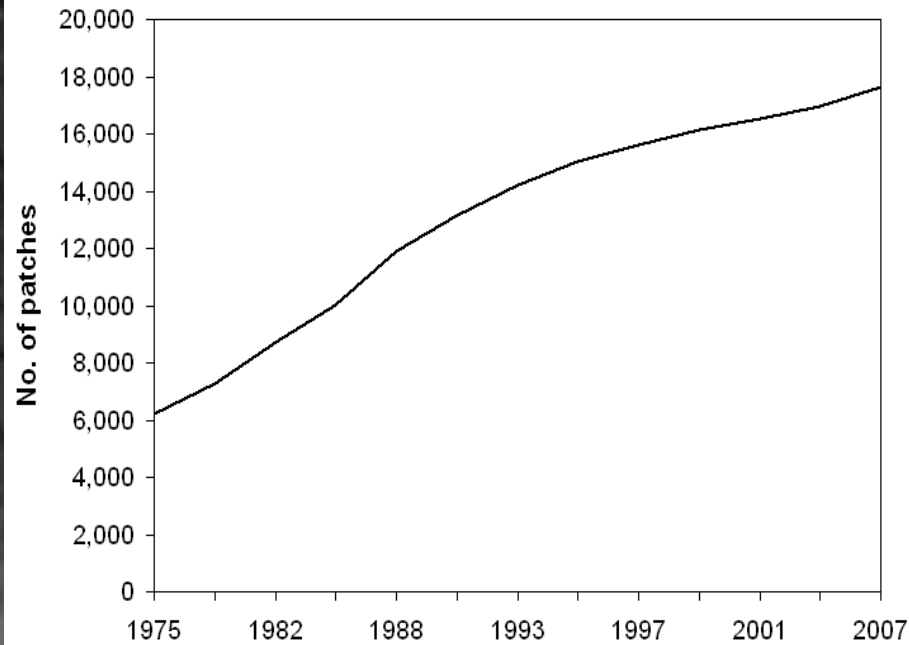
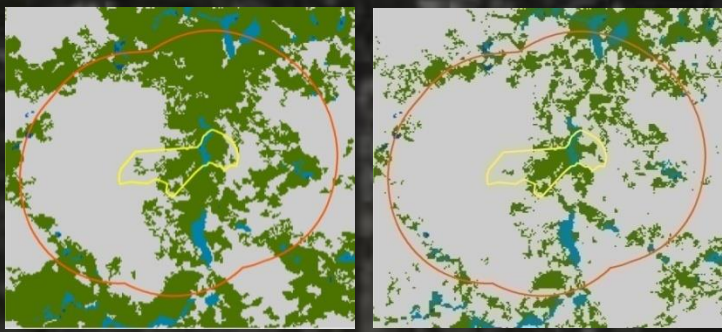
23% of mature forest area (soft, mixed, and hardwood) within protected DWA's was harvested during 1975-2007

Result: habitat change was extensive in areas adjacent to protected DWAs

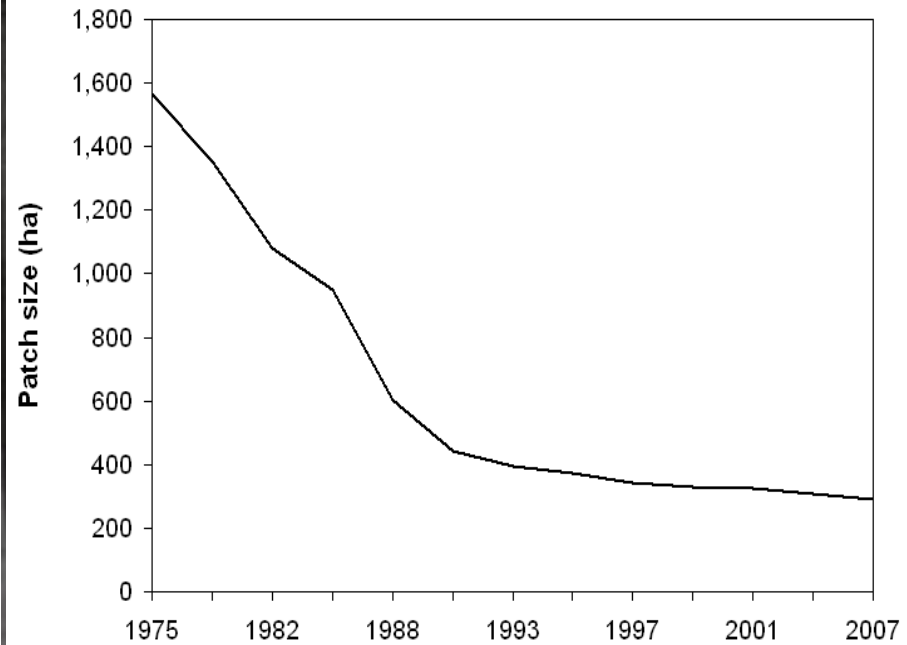


50% of the mature forest area (soft, mixed, and hardwood) was harvested during 1975-2007 in areas within a 1.25 mile buffer outside of protected DWAs.

Result: Remnant conifer patches became fragmented in areas adjacent to DWAs



Number of patches of mature conifer increased 200%.



Average patch size declined 81%.

Results: feasibility and costs of expanding DWAs are substantial

- Currently ~2% of the forested land base is currently included within zoned DWAs in our study area.
- To meet future stated goals for DWAs, all remnant patches of mature softwood >12.4 acres in area would need to be protected as DWAs.
- In aggregate with currently zoned areas, this would represent ~11% of the forested land base in zoned DWAs.
- New zoning would affect new areas with an estimated \$457, 000,000 in current timber value.
- Increased zoning would cost landowners an estimated \$160,000,000 in reduced land value.

Result: zoned DWAs provide limited benefits for conserving broader forest biodiversity

Percent of Wildlife Species Proportionately Represented Plus Those Disproportionately Benefited by Conservation of Deer Wintering Areas (DWA)

% of Maine	Forest Conifer (n = 23)	Forest Hardwood (n = 18)	Forest Generalist (n = 86)	Total Forest (n = 126)	Early Succ. (n = 24)	Total
4.1%	47.8%	5.6%	12.8%	17.5%	8.3%	25.8%

Implications and Applications to the Northern Forest Region

- Broad-scale conversion of mature forest to regenerating forest in areas surrounding zoned DWAs occurred in Maine during 1975-2007, and may be indicative of declines in extent of deer wintering habitat throughout the Northern Forest region.
- Remnant patches of wintering habitat are extensively fragmented in Maine and may help explain why deer have declined in areas with severe winters within the Northern Forest region.
- Although remnant patches of mature conifer forest > 250 acres are increasingly rare (~1% of remaining patches), they have a high probability of being associated with protected DWA's in Maine, and may be a region-wide priority for conservation.

Implications and Applications to the Northern Forest Region

- Deer populations are below objective levels on commercially owned and managed forestlands throughout much of the Northern Forest Region.
- Our experience in Maine suggest that meeting objectives to increase protection to 8-10% of the land base in DWAs would be costly and would require zoning a large proportion of the remnant small mature softwood patches, and those may be of limited use for wintering deer.
- Adding new areas of wintering deer habitat would have limited benefits for overall forest biodiversity.
- Creative landscape-scale approaches will be required to increase the future extent, connectivity and functional quality of deer wintering habitat in the Northern Forest region, and it may take decades to achieve measureable success.

Future Directions

- State-level management goals for white-tailed deer may need to be readjusted to reflect the profound habitat changes that have occurred on commercially managed forestlands in the Northern Forest Region from 1975-2007.
- Given that zoning of a small part of the landscape was ineffective for meeting population-level habitat objectives for deer in Maine, other collaborative landscape conservation approaches will likely be needed to couple forestry and wildlife habitat objectives on managed forests in the region.
- Better collaborations and increased attention to landscape planning among state, federal, private, and public stakeholders will be required to achieve goals of future forest sustainability in the Northern Forest region.

List of Products

- 1-hour seminar of results presented to Advisory Committee, Maine Cooperative Forestry Research Unit, 26 January 2011.
- Presentation of results to Chandler Woodcock, Commissioner, Maine Department of Inland Fisheries and Wildlife, February 2013.
- 1-hour seminar of results presented at University of Maine and attended by UMaine faculty and graduate students in Wildlife Ecology and Forest Resources, as well as by state and federal agency personnel, 15 October 2012.
- Final written report (in preparation) for Maine Cooperative Forestry Research Unit (publication and release by 31 December 2013) and will be made available in *.pdf format to managers, agencies, NGO's, and other interested parties.
- The Principal Investigator met with public affairs personnel at UMaine to plan for press release to occur simultaneous with release of CFRU report.
- A paper is in preparation for submission to a refereed journal (Forest Ecology and Management).