

# Forest Fragmentation in Connecticut: 1985 – 2006

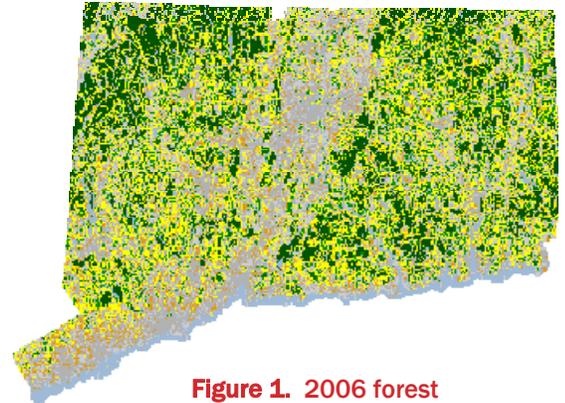
## Research Summary



### About the Project

Forest fragmentation—the breaking up of large forested tracts into smaller and smaller pieces—is considered by forestry, wildlife and water experts alike to have serious implications for the health of our natural resources.

To get a feel for the fragmentation of Connecticut’s forests, and how fragmentation has progressed over time, CLEAR researchers developed a fragmentation model and applied it to the Center’s multi-year land cover data. In 2006, this basic land cover data showed that almost 60% of the state was “forested,” i.e., covered with trees. However, tree cover alone is not a complete indicator of the functional health of forested ecosystems, which can be impacted by proximity to non-forested areas. The results of CLEAR’s forest fragmentation model allow researchers, land use officials, natural resource professionals and the public to obtain a better understanding of the health and status of our state’s forested areas.



**Figure 1.** 2006 forest fragmentation map, with core forest areas in shades of green.

### Methods

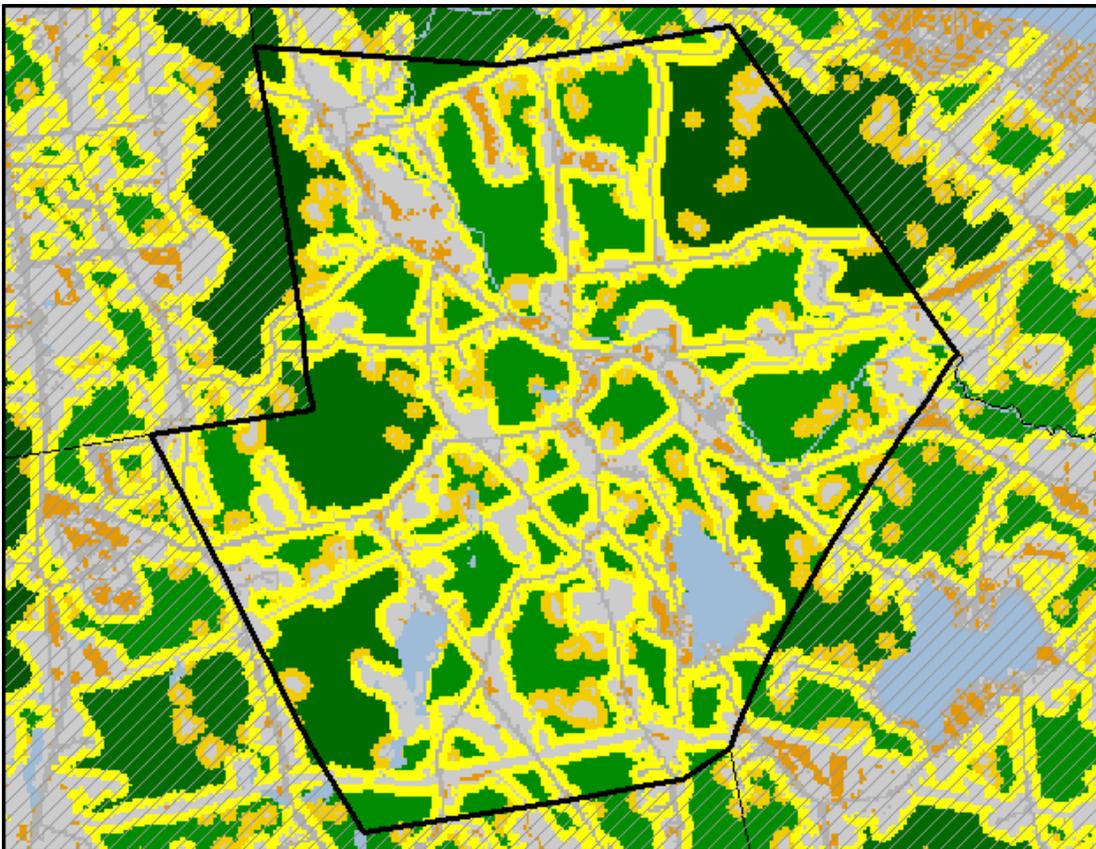
CLEAR researchers first developed a fragmentation model and related GIS tool in 2002. The model and tool were refined in 2009, based on research done by Vogt *et al.* The Landscape Fragmentation Tool maps the types of fragmentation present in a specified land cover type. In this case we applied the tool to forest cover, but the tool can be used on other land cover types. The model was applied to the five land cover datasets of CLEAR’s *Connecticut’s Changing Landscape (CCL)* project, which show statewide land cover for 1985, 1990, 1995, 2002 and 2006 (Figure 2).



**Figure 2.** CLEAR land cover data has 11 categories (left, with development showing in red). For the model, these are simplified to forest and non-forest (green and gray, respectively, middle). Depending on the proximity of each forest pixel to non-forested areas, the model then divides the forest into four major types (right). In order of least to most disturbed, these are core, perforated, edge and patch forest. Core forest is shown in green.

Forested areas were classified into 4 main categories of increasing disturbance—*core*, *perforated*, *edge* and *patch*—based on a key metric called **edge width**. The edge width indicates the distance within which other land covers (i.e. developed land) can degrade the forest. Based on available national research, we used an edge width of 300 feet.

The four forest classes can be seen on Figure 3. **Core** forest pixels are outside the "edge effect," being over 300 feet in all directions from non-forested areas. In this study, core pixels are sub-classified into 3 categories (and three shades of green) - *small core*, *medium core*, and *large core* - based on the area of a given core patch and what forestry research tells us about the significance of those patch sizes. The largest core patches, shown in the darkest green color, are over 500 acres in size. The next least-disturbed category, **perforated** pixels, make up the interior edge of small non-forested areas within a core forest, such as a house built within the woods. These areas, which appear as "holes" or perforations, are shown in light orange. **Edge** pixels, shown in yellow, make up the exterior periphery of core forest tracts where they meet with non-forested areas. The most disturbed category, **patch** pixels (dark orange), are small fragments of forest that are completely surrounded by non-forested areas.

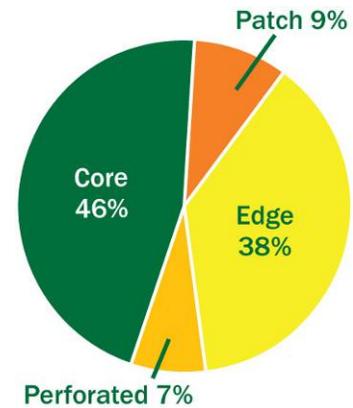


**Figure 3.** 2006 Forest fragmentation map of Andover, CT from the *Your Town* portion of the study website. Gray areas are non-forested land. The three shades of green show core forest areas (larger areas in darker shades). Perforated forest is depicted in light orange, edge forest in yellow, and patch forest (totally surrounded by development) in dark orange. Go to the *Your Town* section to see the results for your own town.

## Results

### 2006 Status

Connecticut had approximately 2922 square miles of forest in 2006, representing about 59% of the state. About 46% of these forested lands (1356 square miles) were core forest, with 38% designated as edge (Figure 4). The largest concentrations of core forest occur in the Northeast, Northwest, and lower Connecticut River Valley areas of the state (Figure 1).



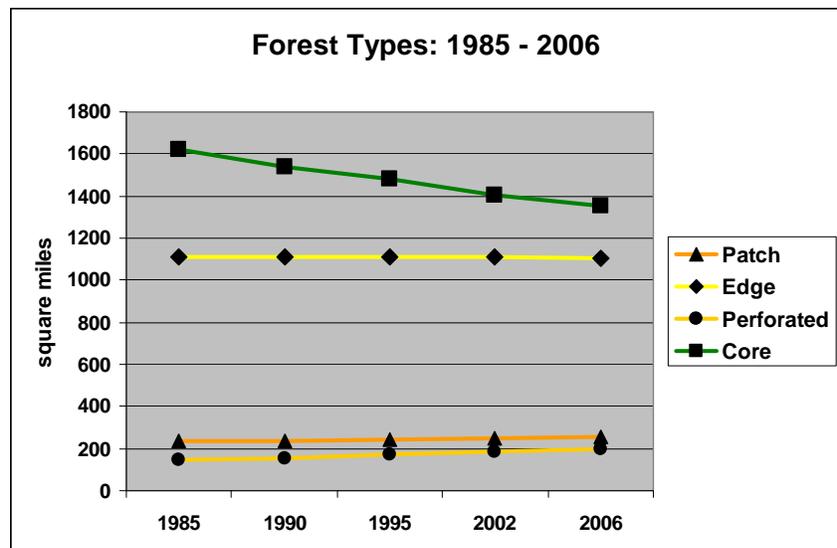
**Figure 4.** Forest cover by type, 2006.

### Changes: 1985 – 2006

During the study period of 1985 to 2006, Connecticut lost about 185 square miles of forest to development—about 3.7% of the forest that existed in 1985.

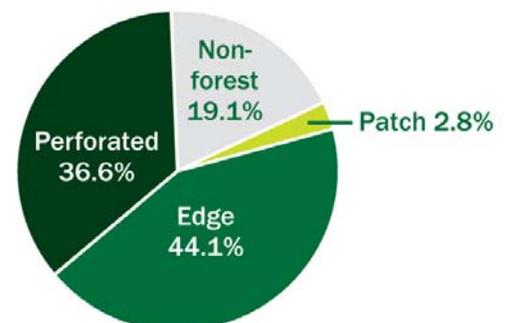
Loss of core forest (all three size categories combined) during the period was about 264 square miles. The fact that core loss is greater than the overall loss of forest seems counterintuitive at first. However, this number includes not only core forest lost to development, but also core degraded to one of the other three (impacted) categories. As can be seen in Figure 5, these three categories either stayed constant or increased slightly over the 21-year study period, as core forest was fragmented into these other types.

A closer look at exactly what happened to core forest in the 21 years shows that while a significant portion was converted completely to non-forest (19.1%), most of the core forest was converted to perforated (36.6%) or edge (44.1%) forest by the encroachment of nearby development (Figure 6). This seems to reflect the prevalent patterns of development in Connecticut during this period, where “holes” of development—in the form of low density subdivisions—are punched into the forested landscape.



**Figure 5.** Changes in area of forest categories over the 21-year study period. While core forest lost considerable acreage, edge forest stayed constant while perforated and patch forest realized slight gains.

**Figure 6.** Where did the core forest go? The pie shows what happened to core forest lost from 1985-2006. While much was converted directly to development, over 80% was degraded to patch or edge forest impacted by nearby development. Note: the numbers in this pie add up to slightly more than 100%, due to the fact that small amounts of core forest were gained during the period.



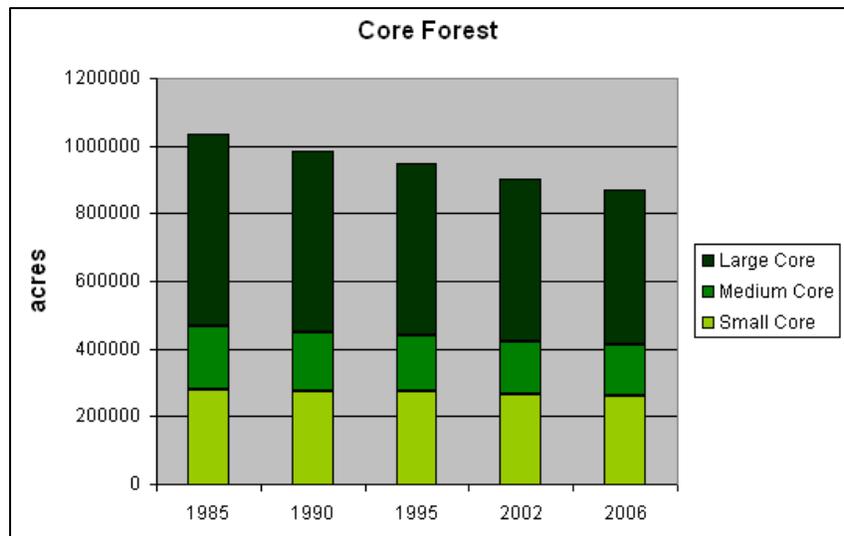
Within the core forest, there were changes over time in the relative distribution of the three size categories. As seen in Figure 7, while the acreage of all three core patch sizes is decreasing over time, the acreage of large core patches (>500 acres) is dropping at a much faster rate. These large forest patches have declined about 3.6% compared to 1985 levels, versus 1.3% for medium patches and only 0.4% for small patches.

## Conclusions

Forest is the single largest land cover category, by far, in Connecticut. As many have noted, since the reforestation of the state following the decline of farming in the twentieth century, never before have so many people lived around and within so much forest.

However, ecologists, water resource experts and foresters tell us that the ability of

Connecticut's forests to provide wildlife habitat, clean water, and economically viable forest products is at least partially dependent on our ability to maintain sizeable tracts of unfragmented forest. What the exact size distribution and characteristics of these tracts should be has yet to be determined. However, this CLEAR study shows that fragmentation and the loss of core forest areas have proceeded steadily over the 21-year period of the study.



**Figure 7.** A “stacked bar” graph showing changes to core forest subcategories over time. Large core areas are declining at a faster rate than the medium and small core areas.

## Forest Fragmentation Website:

<http://clear.uconn.edu/projects/landscape/forestfrag>

*The Center for Land Use Education and Research is part of the University of Connecticut, and a partnership of the Department of Extension, the Department of Natural Resource Management and Engineering, and the Connecticut Sea Grant College Program. This report was written by Emily Wilson and Chester Arnold, Department of Extension, September 2009. © 2009 University of Connecticut. The University of Connecticut supports all state and federal laws that promote equal opportunity and prohibit discrimination. CLEAR publication #090925.1.*