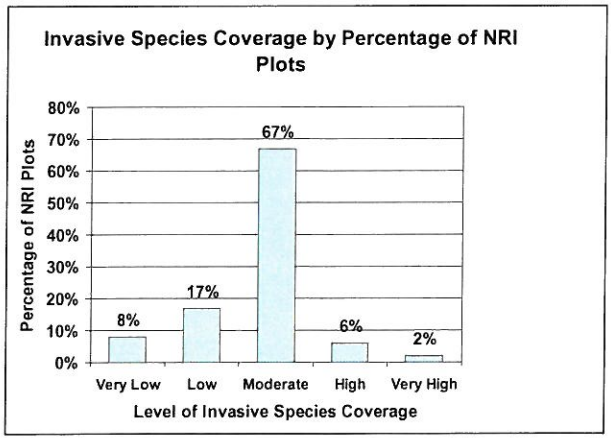
Forest Health

During the Citywide NRI, the Natural Resources Department took inventory of four characteristics and representations of forest health. They included non-native invasive species percent coverage, size class distribution of existing trees, fire fuel loading percent coverage, and stand structure distribution. These indicators may be combined to provide a descriptor of forest health across the landscape.

Japanese Stilt Grass infestation.

NON-NATIVE INVASIVE SPECIES PERCENT COVER was measured by ocular estimate using modified Daubenmire cover classes over the entire plot. The invasive species measure can best be described as a portion of a pie chart that is based on percentages. Distribution classes were as follow; Very Low (<1% coverage), Low (1-10%), Moderate (11-50%), High (51-90%), and Severe (>90% coverage). It is important to note that the majority (75%) of the inventory plots were moderate to severely infested with non-native invasive species. This was an unexpected finding of the inventory and assessment indicating that non-native invasive species are a major factor influencing Lakeland's forests. These invasives reduce biodiversity, severely affect scenic and aesthetic values as well as community character, and also negatively impact establishment of forests and woodlands. Invasive species often displace native plant species and consequently have negative effects on the wildlife species that have evolved to be dependent on those native plants. This leads to a disruption in the function of the entire ecosystem.

Many of the species were identified as Japanese Stilt Grass, Kudzu, several species of Privet, Japanese Honeysuckle, Tree of Heaven, Mimosa, Royal Paulownia, Amur Honeysuckle, Nonnative Roses, English Ivy, Periwinkles, Nonnative Wisterias, Tall Fescue, Bamboos, Chinese Lespedeza, and Callery Pear species. Many of these species are widely used by humans and spread by animals. As depicted in the graphic, 67% of Lakeland's area has a Moderate (11-50%) level of invasive species presence.



Size Class 1 (1"-5.9" DBH)

SIZE CLASS DISTRIBUTION can serve as an identifier of stand maturation and assists with determination of site indices. This measure is based on diameter at breast height (DBH), 4.5 feet above ground, measured in inches. Not all trees within a stand will develop into healthy mature trees. Seedlings must withstand foraging by wildlife, being overtaken and pulled down by vines, and also have to accrue a minimum amount of air, nutrients, and water to simply survive the first size classification of 1-5.9 inches DBH and become established in the landscape. This size class is usually indicative of relatively recent land disturbance or succession from idle land uses back to woodland, as described below, and forests.

For clarification between woodlands and forests, woodlands are "a plant community in which, in contrast to a typical forest, the trees are often small, characteristically short-boled relative to their crown depth, and forming only an open canopy with the intervening area being occupied by lower vegetation, usually grasses" (Helms 200). In contrast, forests are "ecosystems characterized by a more or less dense and extensive tree cover, often consisting of **stands** varying in…, species composition, structure, age class, and associated processes." (Helms pg 70). Stands, as referred to above, are "a contiguous group of trees sufficiently uniform in age, composition, and structure while growing on a site which is sufficiently uniform in quality"(Helms pg 174).

The second size classification is 6-11.9 inches DBH. This classification generally represents the tree establishment phase of forest stand development. In later stages of this class trees begin to produce fruit and seed. This is an integral part of ecosystem functioning as the stand begins to provide soft mast for many different types of wildlife species. At this stage the stand begins to function as a complex, integrated system.

Size Class 2 (6"-11.9" DBH)

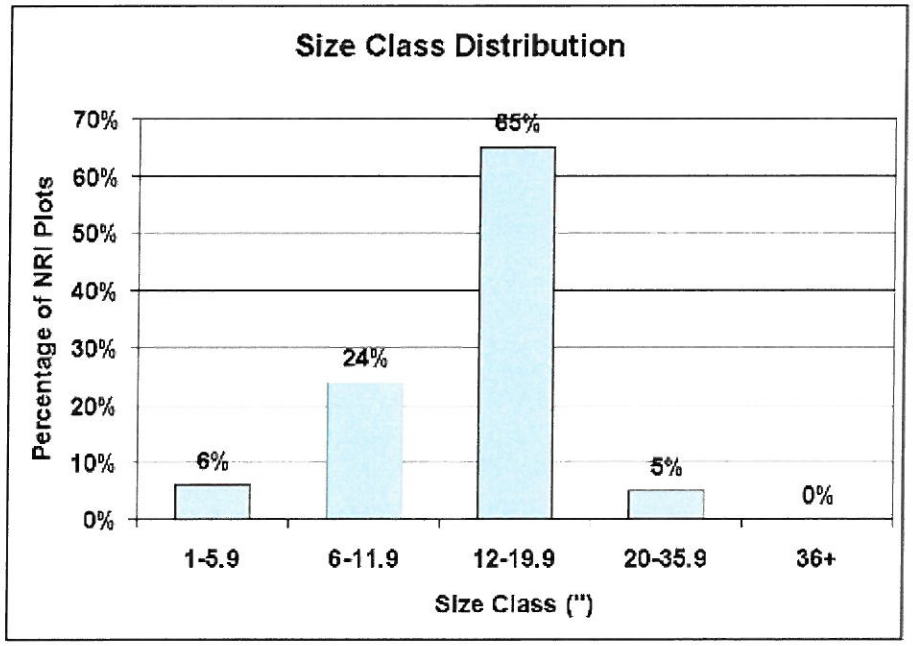
The third size classification is 12-19.9 inches DBH. This classification, for most forest stand types, represents initial canopy closure. Trees in this classification usually begin to shade out the understory making self propagation unlikely in the absence of disturbance. Forests within this stand size class host a wide variety of wildlife species, forest floor vegetation, and provide a large range and amount of environmental benefits.

Size Class 3 (12"-19.9" DBH)

Size class 4 (20-35.9 inch DBH) produces many ecological benefits for floral and faunal communities. This forest stand size class is where the Lakeland Tree Management Ordinance presently focuses protection. While only consisting of 5% of the total forested area in Lakeland, this size class provides the highest amount of environmental benefits such as the interception of rainfall. When a stand reaches this class and covers a large amount of land, the stand becomes capable of providing conditions that are consistent with interior or deep forest habitat: that is, areas with little to no edge effect. This can mean the presence of seldom seen rare forest floor plants as well as an incredibly diverse array of fauna. While not "late successional stage of forest development" or "Old Growth" this stand begins to provide a few of its characteristics (Helms pg 127).

Size Class 4 (20"-35.9" DBH)

The final size classification was 36 inches in DBH and greater. While not first growth, these stands can be seen as mature second growth or "Old Growth" stands. There were no stands found in Lakeland that fit this classification that where at least 5 acres in size or at least 120 feet wide, the minimum criteria set out in the NRI to define a forest stand. This is due in part to past ownership objectives calling for the liquidation of timber resources and past land use practices such as conversion to row crop. Some remnant trees of this size have been found but were not of adequate size or stocking to be considered forest stands. These trees are often referred to as "Wolf Trees", and are usually found with a spreading habit indicating open grown conditions. Both size classes 20-35.9 and the >36 classifications meet the size requirement for full stand protection under the Lakeland Tree Management Ordinance as specimen stands. The distribution of size classifications is depicted in the following graphic.



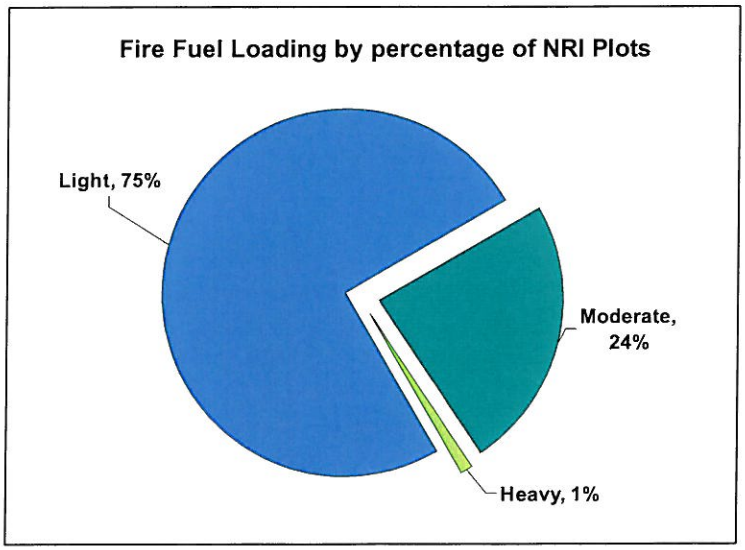
FIRE FUEL LOADING PERCENT COVER is a measurement of fine and course woody debris that was measured by ocular estimate and based on area of the NRI microplot. The following measures are useful indicators for developing fire danger ratings.

The microplot fuel coverage percentage was broken down by size class. Each size class was then delineated by a decay rating classification. The decay classes included measures such as structural integrity, texture, color, presence of invading roots, and presence of limbs or twigs. Fuel size classes are:

- "**1 Hr Timelag Fuels** – Dead fuels consisting of herbaceous plants or roundwood less than one-quarter inch in diameter. Also included is the uppermost layer of litter on the forest floor.
- **10 Hr Timelag Fuels** – Dead fuels consisting of roundwood in the size range of one quarter to 1 inch in diameter and very roughly, the layer of litter extending from just below the surface to three-quarters of inch below the surface.
- **100 Hr Timelag Fuels** – Dead fuels consisting of roundwood in the size range of 1 to 3 inches in diameter and, very roughly, the forest floor from three quarters of an inch to 4 inches below the surface.
- **1000 Hr Timelag Fuels** – Dead fuels consisting of roundwood 3 to 8 inches in diameter or the layer of the forest floor more than about 4 inches below the surface or both" (NWCG pg 15).

Percent cover classifications were defined as follows;

- NONE - 0% fuel coverage;
- LIGHT - 1-33% fuel coverage;
- MODERATE - 34-66% fuel coverage; and,
- HEAVY - 67%+ fuel coverage.



STAND STRUCTURE DISTRIBUTION is a forest stand measurement that is relative to the entire connected stand. Stand structure indicates past disturbances, outward growth of a forest by reverting edge areas back to forest, and age approximation of compartments relative to the connected forested stand. A single stand structure, stand structure 1, is identified by the dominant/co-dominant tree crowns forming a single canopy that are nearly the same height. A forest with two stand structures, stand structure 2, has two recognizable levels of canopy stories. Stand structure three (3) has more than two recognizable stories of canopy and many sizes of dominant/co-dominant trees.

Example of Stand Structure 1

The picture on the right depicts a single stand structure, which is a secondary successional change from idle farmland back to a forested land use. Stand structure 1 provides biodiversity as a young stand while multiple species compete for sunlight. Pioneer species such as Loblolly Pine, Yellow Poplar, and Sweetgum will usually comprise the majority of the dominant trees on the site by out competing shade tolerant species. However, as time progresses the canopy begins to close and the more shade intermediate and tolerant species begin to establish in the understory, becoming the newest structure in the stand. As the canopy closes, shade intolerants disappear from the understory due to low light levels and are replaced by more tolerant species such as oaks and hickory.

Example of Stand Structure 2

The picture to the left depicts two stand structures. In the foreground is the older hardwood remnant: and, in the background is the pine plantation. While both are different stands, both have two stand structures. The remnant has a developed midstory while the pine has a developed hardwood understory. Also noticeable is the amount of light or sunflecks that are reaching the forest floor in the differing forest stands. While the older Oak-Hickory comprised stand shows little light penetration, the more open, young pine plantation has increased levels of light to the forest floor which results in

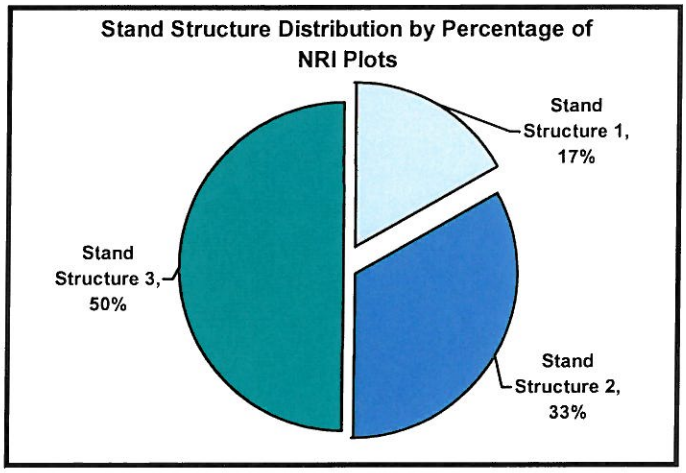
increased plant competition, higher levels of herbaceous and shrubby growth, and provide for differing wildlife habitat characteristics such as food and shelter.

The photo on the right depicts a multi storied canopy or stand structure. In the foreground, there are many types of shade intolerant seedlings and saplings on the edge of this stand as the woods slowly move outward. In the middle ground, there are pine and cedar trees that represent a 15-20 year old secondary succession that has reverted more idle land back to woodland. In the far right back ground there is a remnant "wolf tree". This post oak shows signs of spreading branches that indicate the original edge of the forest. Through absence of routine agricultural maintenance or historic land disturbance patterns, the original forest edge has expanded 60-70 feet in 20-30 years. Farther into the background available light lessens as does the presence of pioneer species such as shade intolerant grasses, shrubs, pines and cedar trees.

Example of Stand Structure 3

Stand structure distributions in Lakeland are as follows.

Stand Structure 1 = 17%
Stand Structure 2 = 33%
Stand Structure 3 = 50%



FOREST HEALTH CONCLUSIONS:

To assess the health of Lakeland's forests, it is imperative to study several components of the forest. Non-native invasive species, fire fuel loading, stand size class distributions and stand structure distribution all provide information to help interpret forest health. Due to the increase in edge area from suburban disturbances, "fragmentation of vegetation often increases the occurrence of invasive, non-native (exotic) plants and animals that occupy edge habitats. Over time, invasive non-natives often out-compete native species, leading to less overall species diversity at the landscape scale" (MN DNR). Not only do non-native invasive plants negatively affect biodiversity, but "approximately 42% of species that are listed in the United States as threatened or endangered under the Endangered Species Act are at risk because of competition with or predation by exotic species" (Wear & Greis pg 63). Measurement of fire fuel loading is a way to assess the possible intensity and probability of forest fires as well as the effects of fire exclusion on the health of the forest. In drier climates, fire regime statistics are more readily available from dendrochronology. However, it safe to assume that fire played an important role in the shaping of southern forest. "The exclusion of purposeful fire from the south…, created an enormous fuel load for the eventual wildland fires. Whether it is sparked by lightening, arson, or human carelessness, wildfire cannot be excluded forever. The increasing population and the expanding wildland-urban interface both create and complicate the issue of wildland fire. Fires no longer regularly sweep great expanses and maintain the southern forests because human development necessitates that fires be suppressed" (Macie & Hermansen pg 135). The effects of fire exclusion on the health of Lakeland's forests will need to be seriously analyzed to guide future resource management decisions. Stand size class distribution and stand structure distribution are a reflection of how the stands have originated, developed, were disturbed, and how the stands have reacted to those disturbances. These are important attributes to compare to the historic landscape patterns in order to assess whether or not large-scale changes in landscapes are occurring and their effects of resource health.