

# Stand Density Index

**What is Stand Density Index (SDI)?** SDI is a measure of the amount of competition occurring in a forest based on the relationship between *number of trees in an acre* and the *quadratic mean diameter* of the forest. These two metrics are calculated from the data collected by plots.

**Why does competition matter?** Increased competition for resources (light, water, nutrients) makes trees more susceptible to stressors such as drought, insect attack, and fire. As foresters, our goal is to create conditions for trees to grow vigorously so that our forests are *resilient*. Forests with a lower stand density index tend to be more representative of what forests looked like in the past, before fire suppression.



Frequent, low-intensity fires used to prevent too much new growth in forests, keeping trees spaced out and eliminating ladder fuels. Now, we have high stand density, high competition, and high likelihood of crown fire if a wildfire were to occur in a forest.

**What is a forester's job?** Before selecting the trees in a forest area (stand) that should be removed, foresters first "cruise" the stand, or use plots to acquire data about the stand. After analyzing that data, they have a better understanding of approximately how many trees should be removed.



When selecting trees to remove, foresters want to *mimic* the effects of low-intensity fire. This means choosing the trees that are smaller, dead trees, and tree species that are less adapted to fire. Additionally, they want to *protect* large and old trees by clearing the smaller trees below them that could act as ladder fuels.

## Activity

1. Each group will have 3-4 students assigned to a plot. All students will work to identify the tree species with the help of an instructor if needed. **1-2 students will measure the diameters of the trees** in the plot with the diameter tape. 1 student will **record the diameters using the following table:**

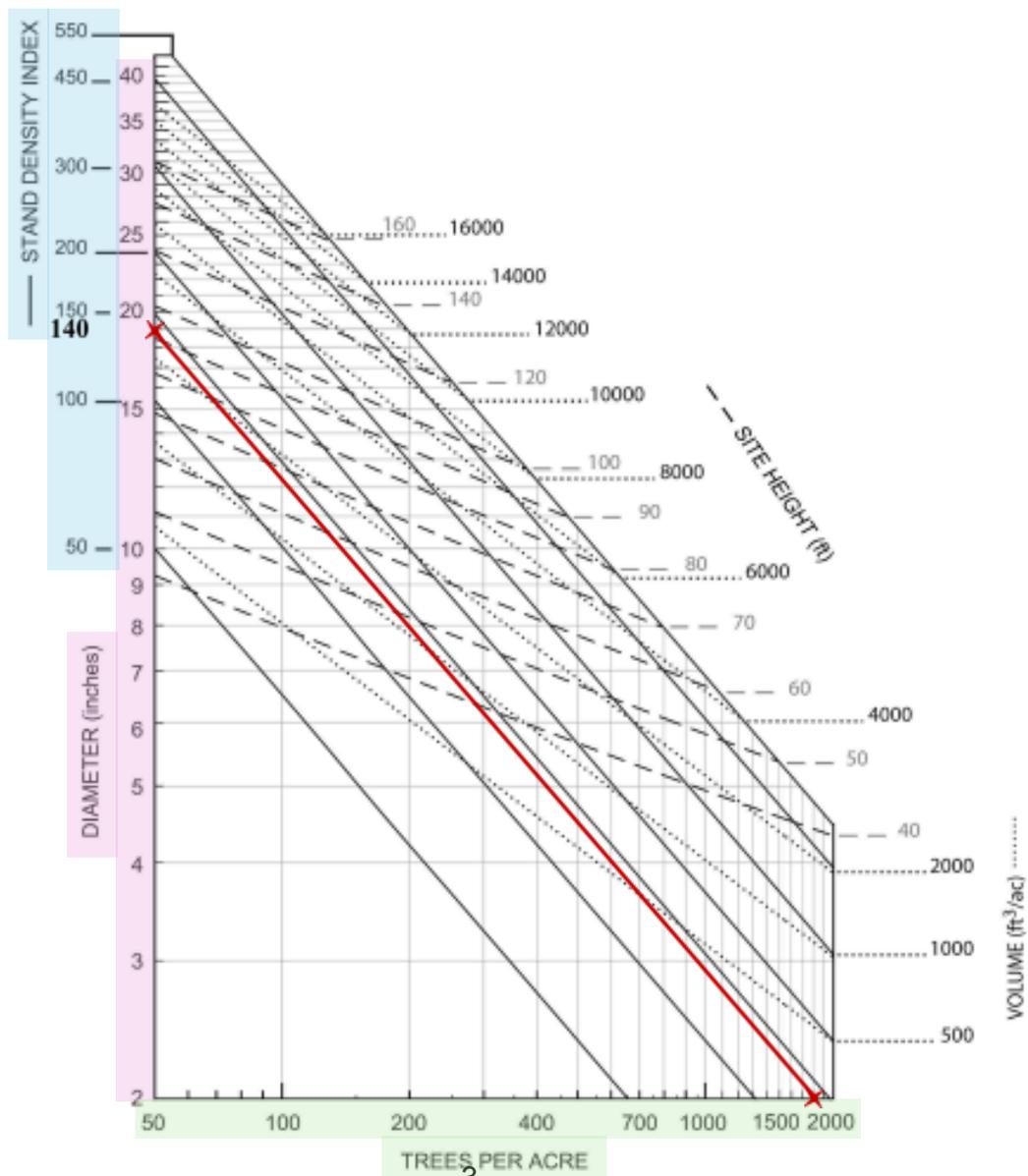
Tree number	Species	Diameter (in)
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		

2. After measuring all of the trees in the plot, **calculate quadratic mean diameter using the following equation**. Quadratic mean diameter (QMD) is slightly different from the regular average diameter. QMD gives more weight to larger trees since they contribute more to a forest than smaller trees.

$$QMD = \sqrt{\frac{\Sigma(dbh^2)}{n}} \text{ which means } \sqrt{\frac{DBH^2+DBH^2+DBH^2\dots}{\text{number of trees in plot}}} = QMD$$

3. **Calculate trees per acre (TPA).** The plot is 0.1 acres, so divide the number of trees in your plot by 0.1.

4. Once you have determined QMD and TPA, it is time to find your stand density index. The graph below is an SDI chart for mixed conifer forests in the Sierra Nevada mountains. **Locate your TPA on the x-axis and your QMD on the y-axis. Draw a line directly up from TPA and directly over from QMD to find where they meet.**



After identifying where TPA and QMD meet, ***draw a line towards the y-axis that is PARALLEL to the existing SOLID lines on the graph.*** The leftmost numbers at the top of the y-axis tell you your stand density index. What is your estimated SDI at the location of your plot? \_\_\_\_\_

5. To minimize competition and encourage vigorous tree growth, **our ideal SDI here is ~140.** The diagonal line for the ideal SDI is already drawn for you: it is red. ***Find where that line crosses your horizontal QMD line and then draw another line straight down to the x-axis from that point.***
  
6. Where the last line meets the x-axis tells you what the trees per acre should be, given the quadratic mean diameter in order to have an SDI of 140.  
What is your ideal TPA? \_\_\_\_\_ Divided by 10? \_\_\_\_\_
  
7. What is the difference between your current number of trees in your plot and the ideal number? \_\_\_\_\_
  
8. As a group, select that number of trees from your plot to remove. Choose trees based on size, species, and spacing from other trees. When you have decided on your “remove” trees, call over an instructor to share your decisions.