

# LS Index(Revised): Northern Pine Forest forest mosaic science notes

## Introduction

The LS Index is a simple scoring system that allows the user to estimate the degree to which any forest stand is in a late-successional condition. The LS Index can be applied to a stand in less than 30 minutes. It can be conducted at any time of year. The LS Index was designed to provide a quick, accurate estimate of the late-successional condition of a stand to help foresters manage and conserve this uncommon and diminishing forest age class. This document describes the LS Index for northern pine forest (Fig. 1).

## The basis of the LS Index

The northern pine LS Index is calculated using scores for one indicator: largetree (>16" or 40 cm DBH, alive or dead) density. This variable was statistically derived from a large field data set containing many potential LS indicator variables (see Whitman and Hagan FMSN 2009-1). Large tree density correlates with other attributes of old forest, including the volume and the density of large snags and logs, as well as density of trees with LS lichens and bryophytes. The index ranges from 0 to 10 and increases with forest age.

## How to calculate the LS Index

*Equipment needed*: stand map, compass, hip chain (or use pacing), and diameter tape.

*Field Procedure*: Run a hip chain (or pace) for 10 chains (~200 m) and count the number of large ( $\geq$  16" DBH) trees (alive or dead) within ¼ of a chain (~5 m) on either side of the transect (a ½ x 10 chain plot [½ acre] or ~ a 10 x 200 m plot [0.2 ha]). Tally up the number of large trees. The number of samples required to precisely estimate a stands LS Index will vary depending on how much the LS Index varies throughout a stand and stand size. We recommend 1-3 transects per stand.

Calculating the LS Index: Use the look-up tables below to derive the LS Index score. If you chose to sample some other size of fixed area, you can convert the densities to a per-acre or per-hectare scale, and use the look-up tables accordingly.





Fig 1. Old-growth northern pine forest in Gero Island, Chesuncook Twp, Maine (A. Whitman photo).

**Example:** Suppose you tallied up 11 trees  $\geq$  16" DBH along the 200 m (10 chain) transect. The corresponding LS Index score for 11 trees is '7' (table left).

Threshold betwee	n economic mature and LS stages

Threshold above which a stand is old-growth or is statistically similar to old-growth.

How to Interpret the LS Index: LS Index scores for stands in different age classes are shown in Fig. 2. Scores above '5' strongly suggest that the stand contains significant LS value. Stands above '8' suggest that the stand may be an old-growth stand. If the stand scores '5' to '8', we recommend applying a harvest prescription that retains as much LS value as possible. Trees > 16" DBH should be targeted for retention, especially if they have long Usnea spp. or other LS arboreal lichens such as Bryoria spp or Lobaria quercizans. If the stand scores '8' or above, we recommend setting the stand aside from harvesting or asking for expert advice on how to harvest the stand with careful consideration of LS attributes. In most cases, stands that score below a '5' require no special management attention for LS conservation. Occasionally the LS Index may not reflect the true LS condition of the stand because either the stand is outside the range of conditions under which the LS Index was developed (e.g., plantation pine) or is erroneously classified (the LS Index is a probabilistic tool, hence it will occasionally be wrong). Common sense usually can resolve the rare occasion when the LS Index and stand conditions are conflicting.



Fig 2. Mean LS Index values for stands in different age classes.

#### Upland Northern Pine Forest Composition: Sites used to generate

this index were  $\geq$  50% (by basal area) white and/or red pine (*Pinus strobus* and *Pinus resinosa*) in the overstory. They occurred at elevations below 2000 feet, on moderately well drained loams, sandy loams, and sandy soils on esker slopes, outwash plains, rocky soils or rocky slopes. Other stand dominating species were red spruce (*Picea rubens*), eastern hemlock (*Tsuga canadensis*), balsam fir (*Abies balsamea*), paper birch (*Betula papyrifera*), and aspen species (*Poplus* spp.). Tolerant hardwoods (sugar maple - *Acer sacchrum*, American beech - *Fagus grandifolia*, and yellow birch - *Betula alleganinesis*) and cedar (*Thuja occidentalis*) occasionally occurred in some stands. White pine tends to grow on moister sites than red pine so usually is associated with other northern conifers. The northern pines stands are common in eastern Maine and central New Hampshire, and uncommon in western and northern Maine. Old sites contain many lichen species that are rare or absent from younger stands.

#### NE forest types (classification system):

New Hampshire Natural Areas Program: Hemlock - white pine forest Red pine-white pine-balsam fir forest

Maine Natural Areas Program: Pine - hemlock/spruce forest Red pine woodland

Society of American Foresters: 15 - Red pine 21 – Eastern white pine 22 - White pine-hemlock (in part)

NatureServe: Laurentian-Acadian Northern Pine-(Oak) Forest Laurentian-Acadian Pine-Hemlock-Hardwood Forest

USDA Forest Service (FIA): 102 Red pine 103 Eastern white pine 104 Eastern white pine / eastern hemlock



Old fire scar on a red pine in an old growth northern pine forest, near Gassabias Lake (T41 MD), Maine (A. Whitman photo). Current efforts to suppress forest fire prevents natural fire from commonly occurring in northern pine forest.

**Current Status and Past Harvest History:** White pine has been harvested in Maine and New Hampshire for over 300 years. Formerly common, old-growth pine forests may now be uncommon due to their high demand for ship masts and then building material. The abundance of white pine forest probably has declined because white pine is easiest to grow in stands dominated by other conifer species. Red pine abundance has probably also declined because it is a timber species that lacks markets to justify active its management. As a result there are relatively few acres of late-successional or old growth northern pine forest in Maine and New Hampshire. Many northern pine stands are managed as mixed conifer stands usually with the primary goal of growing spruce and fir but also maintaining pine species.

**LS Ecology:** Gap replacement and infrequent fire are the major natural regeneration modes for LS and OG stands. Historically frequent surface fires, large wind throw areas, excessively drained soils, and rare canopy fires perpetuated this forest type for many centuries but, in the absence of fire, other tree species may eventually take over on many sites. White pine saplings can grow underneath a pine canopy and will grow up to fill canopy gaps. Red pine seedlings and sapling require greater light levels and hence larger canopy openings than white pine in order to survive and grow. Stands in areas with extensive fire history may be comprised of several cohorts, each the regenerated from each fire. The oldest trees can be over 300 years and grow to greater than 35" DBH. Some sites with relatively young pine stands (<150 years old) may not have been entered in part because past fire has reduced timber levels below historical merchantability standards (although current merchantable standards have now made these stands economical).