STAND STRUCTURE ALGORITHM REVISION
WORKGROUP – REPORT

Introduction

A sub-group of the 'Clatsop and Tillamook State Forests Strategies for the Achievement of the Board of Forestry Performance Measures' Working Group was formed in February, 2008 to evaluate and improve the stand structure algorithm developed in 2003. This revision is part of an on-going improvement process; after the results have been applied for a period of time, the workgroup will reconvene to assess its accuracy and incorporate further improvements.

The primary goal of the group is to improve the stand structure algorithm used in the classification of forest stands (as described in the Northwest Oregon Forest Management Plan) in order to:

1. Better classify individual stands using current inventory data.
2. Grow stand structure forward in the Stand Level Inventory Program (SLI) so that a district wide summary and map can be provided at any time.
3. For the purposes of modeling, improve the projection of stand structure development in the yield tables.

The members of the sub-group are: Dan Goody (Acting Astoria Assistant District Forester), Erik Marcy (Forest Grove Management Unit Forester), Barbara Moore (Tillamook Planning Unit Forester), Rob Nall (State Forests Operations Coordinator), Todd Reinwald (Northwest Oregon State Forests Planning Coordinator), Doug Robin (State Forests Staff Silviculturalist), and Clint Smith (Northwest Oregon Wildlife Biologist).

Background

The purpose of the algorithm is use quantitative measurements from the State Forests ~~Program's~~ Division's SLI to calculate the forest stand structures that are described qualitatively in the Northwest and Southwest Oregon State Forest Management Plans. When the algorithm was originally developed there were a limited number of stands inventoried and the algorithm was based on field reviews of a relatively small number of stands. Therefore, it was planned to review the algorithm once more SLI data was collected.

The algorithm used a variety of stand characteristics to determine the stand structures, including live trees (diameter, heights, trees per acre, and relative density), snags, down wood, and understory vegetation. While it is always difficult to define numeric classifications of a natural continuum, the most difficult part of developing this algorithm was defining numeric criteria to identify stands with "significant layering of tree crowns".

Diameter Diversity Index (DDI), a method developed by Dr. Thomas Spies and Rob Pabst, was incorporated into the algorithm to provide a quantitative indicator of canopy layering. The DDI is an indicator of tree size diversity, and therefore the structural diversity of a forest stand. Based on information provided by Dr. Spies, multiple SLI runs, and field verification; it was determined that stands with a DDI greater than 6.5 (on

a scale of 1-10) could confidently be classified as being layered. It was also determined that complex stands could occur with DDI's lower than 6.5, so a "gray area" was defined for stands with DDI's ranging from 5.5 to 6.5. Stands within this range meeting the other criteria for Layered (LYR) or Older Forest Structure (OFS) are reviewed in the field to determine the actual structure.

This algorithm was modified for use in the generation of yield tables for the Harvest and Habitat Model. The algorithm in the yield tables relied on live tree data, since neither a calibrated ~~a~~ decay model for snags and down wood nor a model for growing understory vegetation were available.

Revision Process

After a significant portion of the stands were inventoried, it was found that the algorithm was working well for identifying Regeneration, Close Single Canopy, and Understory stand structures. However, the algorithm was not identifying many Layered or Older Forest stands and approximately 25-35 percent of the measured fell into the DDI "gray area".

The work group conducted two meetings and three field reviews to identify and validate changes to the algorithm. At the initial meeting, the workgroup reviewed the results of inventory to date, identified problem areas, and discussed potential solutions. The most significant problem was the DDI "gray area". After the initial meeting, districts conducted extensive analysis of their SLI and numerous field checks of stands in the DDI "gray area" in order to test and refine the potential solutions.

The workgroup then conducted a field review on each district to further refine and validate the solution, as well as ensure that the solution functioned correctly in a variety of stands across all three districts.

Results

As stands with DDI's in the range of 5.5 and 6.5 were field checked, a trend was detected that stands with multiple tree species, especially two or more conifer species, were often classified as layered during filed reviews even though they had DDI's below 6.5. Therefore, the workgroup revised the criteria for identify stands with "significant layering of tree crowns" from a single criteria of a DDI of 6.5 for all stands to series of criteria based on the species composition of the stand (as indicated by the SLI species group [1D, DX, 1W, etc.]).

The criteria for identifying stands with "significant layering of tree crowns" are:

a. 1D – Douglas-fir comprises more than 80% of the Basal Area (BA)
    i. With >= 10 sq. ft. of BA/acre of a second conifer species – DDI >= 6.0
    ii. With < 10 sq. ft. of BA/acre of a second conifer species – DDI >= 6.5

b. DX – Douglas-fir is the predominate species by BA and comprises at least 20% of the BA (normally it is over 50%), but does not meet 1D criteria. It is split into two subgroups, based whether the remaining basal area is dominated by hardwoods; that is 80% of the remaining non Douglas-fir is red alder, bigleaf maple or other hardwood (e.g. BA/Acre DF = 60, RA = 36, GF = 4).
    i. Second species is not hardwood dominated – Of the remaining BA, < 80% is composed of red alder and/or bigleaf maple, then DDI >= 5.8

ii. Second species is hardwood dominated – Of the remaining BA, >= 80% is composed of red alder and/or bigleaf maple, then DDI >= 6.5

c. 1W – Western hemlock comprises more than 80% of the BA
   i. DDI >= 6.5

d. WX – Western hemlock is the predominate species by BA, but does not meet 1W criteria
   i. DDI >= 5.8

e. 1H – Hardwood mix comprises more than 80% of the BA
   i. DDI >= 6.5

f. HX – Hardwood mix is the predominate species and comprises at least 20% of the BA, but does not meet 1H criteria. This species group also uses size class in the criteria
   i. Large Trees (size class 4 and 5) – Where the average DBH of the largest 40 trees in the stand is >= 20 inches, DDI >= 6.0
   ii. Smaller Trees (size classes 1 – 3) Where the average DBH of the largest 40 trees in the stand is < 20 inches, DDI >= 6.5

g. OT – All other species (singular or mixtures)
   i. DDI >= 6.5

Future Improvements

The workgroup identified several projects that could be undertaken to improve the understanding and calculation of stand structures from measured data in a future revision, including:

- Developing a species diversity index for understory vegetation;
- Incorporating a decay model for snags and down wood;
- Develop a predictive model for understory vegetation based on stand and site conditions.