10/31/94 (Revised 4-16-2007)

REFERENCE #5

REFORESTATION STOCKING SURVEY PROCEDURES
Forest Practices Program
Oregon Department of Forestry

The Oregon Forest Practices Act requires that forestland be reforested when tree stocking following an operation is reduced below levels set by the Board of Forestry in administrative rules. This publication will explain how landowners, Oregon Department of Forestry stewardship foresters (SFs), and others can evaluate post-operation tree stocking to determine if reforestation is required. These same methods can also be used to determine if reforested areas are adequately stocked to meet the forest practice rule requirements.

When May Stocking Surveys Be Needed?

Operation areas should be evaluated immediately after completion of harvest to determine if reforestation is required. Stocking surveys may be needed to make this determination. If reforestation is required, the stewardship forester (SF) will establish a compliance time line that will begin at the completion of the operation or 12 months after stocking was reduced, whichever is earlier.

When artificial reforestation methods are planned, units should be inspected by SFs to determine if planting or seeding has occurred. Planting or seeding is required within 24 months after the start of the compliance period. Stocking surveys are not needed to make this determination. Final compliance surveys may be needed six years after completion of the operation to determine if the area is adequately stocked with free to grow trees.

The timing of final compliance surveys when natural reforestation methods are used may vary, based on time lines set in approved plans for alternate practices.

Step 1: Stratifying the Harvest Unit and Determining Acreage

Following timber harvest, a operation area may be:

1. Uniformly stocked (such as following a thinning or overstory removal),
2. Uniformly non-stocked (such as following a clearcut), or
3. Irregularly stocked (such as after a group selection or salvage harvest).

Harvested areas may be reforested using planted or naturally seeded trees. While planted areas are initially uniformly stocked, both artificial and natural reforestation methods may result in an irregular distribution of trees by the time final rule compliance inspections are made. To simplify and improve the accuracy of stocking surveys, it may be necessary to divide, or "stratify" a harvest unit into more homogenous sub-units. When stocking is fairly uniform,

stratifying the unit is not necessary.

Units with irregular stocking should be stratified into four categories through visual inspection:

1. Areas obviously well-stocked to meet forest practice rule requirements;
2. Areas obviously not stocked with enough trees to meet forest practice rule requirements;
3. Areas with borderline stocking that may or may not be adequate.
4. Areas not capable of producing 20 cubic feet per acre per year (Cubic Foot Site Class VII).

If more than 10 percent of the acreage of irregularly stocked units is stratified as category 2 or 3, stocking may not be adequate to meet forest practice rule requirements. Stocking surveys for compliance purposes are not necessary where visual inspection indicates the operation area is either adequately stocked or clearly understocked. Therefore, compliance stocking surveys should focus on determining stocking on:

1. Uniformly stocked units with borderline stocking that may or may not be adequate, and
2. Those stratified portions of irregularly stocked units with borderline stocking that may or may not be adequate.

Once the area that needs to be surveyed has been identified, the acreage of that area must be determined. Using a simple dot grid template and a map with known scale, acreage can be estimated with sufficient accuracy.

Step 2: Stocking Survey Plot Design

Stocking surveys will consist of a series of 1/50-acre (16.7-foot radius) circular plots (optionally combined with 10-Basal Area Factor variable plots). Please note that circular plots may underestimate the stocking of trees distributed in a uniform square or rectangular pattern. Since these methods are intended for areas that are poorly and irregularly stocked, this should not be a problem.

If the area to be surveyed is less than 40 acres, the entire area should be surveyed at the intensity of one plot per every two acres, but with a minimum of five plots. For areas larger than 40 acres, select the 40-acre portion that appears to have the lowest level of stocking and survey at the same one plot per two acre intensity with a maximum of 20 plots. **Please note this sampling design is intended to provide a quick estimate of stocking. More intensive sampling may be needed for results with high statistical reliability.**

Plots should be taken along a straight line using a compass bearing. Multiple plot lines should be parallel and a compass bearing should be selected that runs plot lines across stand variation. Plot centers should be no closer than two chains (132 feet) and no further apart than four chains (264 feet). Survey lines should be five to ten chains (330 to 660 feet) apart. Numbered plot

locations should be drawn on a map of the survey area.

Step 3: Data Collection

Equipment needed for stocking surveys includes a measuring tape, a "jake" staff (or an assistant to hold the other end of the tape), hand compass, tree diameter tape, flagging, survey form, and a pencil. In addition, when using the optional variable plot method, a relaskop or a 10 Basal Area Factor wedge prism is needed.

Pace to the first plot center using the predetermined compass bearing. Use the jake staff to mark the plot center and use the measuring tape to establish the 1/50 acre (16.7-foot radius) circular plot. Hang flagging as needed to mark the plot center and perimeter. If the center of a tree bole is within the plot perimeter, it is considered an "in" tree. Use the survey form to tally each free to grow tree present within the plot. The survey form segregates trees by size class (seedlings, saplings/poles, and trees 11-inches in diameter at breast height (DBH) and larger. All hardwood tree tally marks should be circled to separate them from conifers. Remember, no more than 20 percent of required stocking can be met with post-operation residual hardwood trees without approval of a plan for alternate practices.

A free to grow tree is a tree of acceptable species and of good form that has a high probability of remaining vigorous, healthy, and dominant over undesired competing vegetation. For the purpose of this definition, trees are considered well distributed if 80 percent or more of the portion of the operation area subject to the reforestation requirements of the rules contains at least the minimum per acre tree stocking required by the rules for the site and not more than ten percent contains less than one-half of the minimum per acre tree stocking required by the rules for the site.

In general, a tree will be considered free to grow if:

1. It is not severely damaged by insects, disease, fire, wildlife, weather, or logging;
2. It exhibits the potential for continued height growth, consistent with the normal growth for the species on similar sites;
3. It has at least one-third of the tree height in full, live crown; and
4. It is taller than, and out-competing any grass, shrubs, or undesired trees growing within a ten (10) foot radius from the tree.

These general criteria may be modified on a case-by-case basis following on-site evaluations by stewardship foresters if they determine that the free to grow definition can be better satisfied.

Remember trees that appear to be healthy and vigorous but which are overtopped growing within ten feet of a more dominant tree are generally not considered free to grow.

Continue this procedure on the other plots until the required number of plots has been measured.

Optional variable plot method

A variable plot method may be substituted for the fixed circular plot method to directly measure the basal area per acre of 11-inch DBH and larger trees. Seedlings and sapling/pole size classes are still sampled using the fixed plot method.

The survey form contains an optional column to tally trees that are within the variable plot of a 10 Basal Area Factor wedge prism. The variable plot method may be faster than the fixed plot method for tallying "in" 11-inch DBH and larger trees. If a tree is "in" on more than one variable plot, record it each time.

Step 4: Data Analysis

Use the instructions on the survey form to sum the plots data and determine if stocking is adequate. More plots should be taken if the results after measuring the minimum required number of plots are inconclusive.

The minimum tree stocking standards in the rules are:

Site Productivity	**Seedlings** (less than 1-inch DBH*)	**Saplings and Poles** (1 to 10-inches DBH)	**Trees 11-inches DBH and larger**
Cubic Foot Site Class VI (Ponderosa pine 100-year site index 40 to 63)	100 per acre	60 trees per acre	40 square feet of basal area per acre
Cubic Foot Site Class IV and V (Ponderosa pine 100-year site index 64 to 108)	125 per acre	75 trees per acre	50 square feet of basal area per acre
Cubic Foot Site Class I, II, and III (Douglas-fir 100-year site index 124 and higher)	200 per acre	120 trees per acre	80 square feet of basal area per acre

In both even-aged and uneven-aged stands, the stocking of residual seedlings, saplings and poles, and larger trees is weighted by the rules to recognize the greater use of the growing potential of a site by larger trees. For this purpose, 100 free to grow seedlings are considered equivalent to 60 free to grow saplings and poles, which are also equivalent to 40 square feet of basal area of free to grow trees 11-inches DBH and larger. See the example below where these equivalencies are

applied.

The survey form applies the appropriate weight to the trees surveyed using the ratios set in the rules to determine, on a per acre basis, the number of actual seedlings and the number of "seedling equivalents" based on the actual number of saplings, poles, and larger trees. Fixed plot data for trees larger than 11 inches DBH are converted to seedling equivalents per acre based on approximate DBH/basal area relationships. Basal area data collecting using the variable plot method is also converted to seedling equivalents per acre.

The calculated results can be compared to the productivity-based stocking standard applicable to the operation area to determine if free to grow tree stocking is adequate.

Example using stocking equivalents described in OAR 629-610-0020(7):

A partial cut harvest unit on Site IV forestland contains the following tree stand after the operation:

Average number of seedlings per acre = 35
Average number of saplings and poles per acre = 8
Average square feet of basal area per acre of trees 11-inches DBH and larger = 15

[From rule 020 (7), 1 seedling = 0.6 saplings and poles = 0.4 square feet of basal area of 11-inch DBH and larger trees; therefore:

8 saplings and poles per acre / 0.6 = 13 seedling equivalents
15 sq. ft. of basal area per acre / 0.4 = 38 seedling equivalents

35 + 13 + 38 = 86 seedling equivalents.]

<u>One hundred and twenty-five (125) seedlings or equivalent larger trees is the minimum stocking standard for Site IV land; therefore, establishment of an additional 39 free to grow seedlings per acre is required on this site.</u>