



# Christmas Tree Notes

## Selecting Sites for Fraser Fir Production

CTN-036

**Introduction:** Some Fraser fir growers continue to incur costs for site selection decisions that they made years ago. The decision to set a particular field affects all subsequent management activities for the trees on that site, for good or worse. Natural fertility of the soil will determine both the quality of tree growth and the cost of fertility management. Aspect and elevation can influence the incidence of several pests. Clay soils, soil depth to bedrock and/or water drainage patterns can predispose Fraser fir to infection by *Phytophthora* root rot. While certain management activities can offset the effects of a poor or marginal site, there usually is an increase in the cost and time for production as compared to better sites. By considering a full range of site factors, many problems can be avoided in the site selection process.

**Elevation and Aspect:** Elevation and aspect can define the suitability of a site for Fraser fir, particularly in regard to the climate and soil of that site. The climates of either cold and exposed high-elevation sites (ridges and peaks above 4,500 feet) or very warm low-elevation sites (south-facing slopes below 3,000 feet) can adversely affect Fraser fir root growth, bud set and tree quality. At either extreme, the period of time that tree roots function may be limited.

Climate and temperature also largely influence the formation of soil on a site. Organic matter decays and minerals weather faster on warmer sites. Lower elevations and southern aspects generally have less organic matter in the topsoil and more clay in the subsoil than higher elevations or northern aspects. At elevations above 3,400 feet, dark, loam soils can be found at any aspect. As elevation drops below 3,000 feet, aspect becomes more important. At 2,400 feet, a south-facing slope may have too much clay in the subsoil to avoid disease problems where the north face of the same ridge can have a less weathered, loamier subsoil that drains well. Aspect will have a greater influence on steeper slopes than on level ground.

Experiencing survival problems associated with *Phytophthora* root rot (PRR) at low elevation clayey sites, some growers have shifted to high elevation sites. While they greatly reduced the risk of root rot, growers have experienced a different set of site related problems. Climate can be severe. High elevation trees are at greater risk of being whipped by winds, beaten by hail, or pruned by late spring freezes. Well-drained soils may become excessively dry during droughts. High-elevation organic soils have different fertility issues that require individualized management. These potential problems are not insurmountable and do not take the land out of production as PRR would, but can increase production costs and rotation length.

**Landscape:** Farmers have always "read the lay of the land" to help in site selection. This is especially important for Fraser fir, where small changes in soil drainage can make a big difference in the development of *Phytophthora* root rot. Landscapes (or topography) range between concave areas that collect water and convex areas that shed water. Look for and avoid planting any hollows, gullies, ravines, or dips that indicate intermittent streams or drainage areas. Changes in vegetation can indicate changes in soil type or drainage and can be useful in reading the landscapes. Rushes often indicate wet areas. Patches of green grass

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in winter also reflect wet areas that do not freeze. Also note any depressions or sunken areas on slopes that historically are the result of earth-slides or tree-falls. These areas will have subsoils at the surface and poorer drainage than surrounding soils. Any of these poor drainage areas can become future *Phytophthora* problem areas.

While evaluating the landscape, it is also important to note any tree lines that will create shade problems or other landscape features that might create a frost-pocket by restricting airflow. Poor airflow and increased humidity can also be a factor in the occurrence of pests such as hemlock rust mite or Botrytis shoot blight. Be sure to consider landscape features beyond the property line that may impact your fields.

**Slope and Drainage:** Slope and water drainage must be considered carefully when selecting a site. Most Fraser fir in North Carolina are planted on sloping land because it drains better than flat land. Water moves slowly out of flat land which can remain saturated long enough for *Phytophthora* root rot to get started. However, sloping land does not guarantee a good site for Fraser fir, nor is flat land always bad.

The position of a site in relation to water flow is critical. Flat land can be well-drained on a mountain top or be very wet at the foot of a slope where water collects from the watershed above it. Sloping land at the bottom of any hill, near surface water, or above a flat area can have a higher water table and be slower to drain than other positions in the landscape. It is also important to remember that water drainage occurs both across the grade of the slope and internally in the pore space of the soil. A good site must be well-drained in both ways.

Avoid moderate to severe slopes within the selected site. Steep slopes are difficult to work. An extra year or two of growth is required on steep slopes to produce a uniform whorl of branches at the base of the tree. Possibly a result of uneven lighting, many steep northern- and southern-aspect sites exhibit uneven bud set from the north to south side of the trees. Gentle to moderate slopes tend not to have these problems.

**Soil Sampling:** Soil characteristics for a potential site must be evaluated thoroughly. Many growers take a surface soil sample (0-4 inches) for nutrient analysis. Additional deeper samples of 4-8 inches or even 12-20 inches will indicate what trees have to draw on during periods of stress. The soil reports provide a good indication of the amount and type(s)

of lime and fertilizer needed to provide optimum fertility for Fraser fir growth. Multiple nutrient deficiencies, toxicities, or pH imbalances should be "red flags" for selecting that site. The process of collecting soil samples also provides a good indication of the topsoil color, texture (amount of sand, silt, and clay), and compaction. While there is no "right" topsoil, darker, loamy, and less compacted soils generally are good.

**Soil Depth:** Simply looking at the surface soils is not enough, however. Using a shovel or preferably a soil auger, determine the depth of the topsoil and the subsoil. Mountain soils will vary from 20 to 60 inches to bedrock. Deeper soils will generally provide more water and nutrients during dry periods and provide a greater depth of aerated soils during the wet periods than will shallow soils. Shallow topsoils generally will not sustain more intensive site preparation or tillage practices that can result in either erosion or compaction. The soil survey conducted by the Fraser fir task force in 1999 showed a strong link between both shallow soils and percentage of clay content and the incidence of *Phytophthora* root rot.

**Subsoil:** By looking at the soil profile you should get an indication of water drainage, depth of the root zone, and some of the tillage options that are feasible on that site. The ease with which the hole is dug can tell you how much rock there is present. Pay particular attention to any hard layer such as a plow pan or clay layer which could inhibit the drainage of surface soils. Examine the structure of the subsoil. A soil with small clods or a granular structure will have more pore space and air for optimum root growth than a blockier, more clayey soil. If the subsoil is poor, no amount of tillage, subsoiling, or amendments will alter it for a successful cycle of Fraser fir.

**Soil Color:** Soil color can be used to evaluate your site. Dark topsoils have more organic matter than light topsoils. Darker subsoils (brown or red) are usually more fertile than light-colored subsoils (yellow or white). Take note of any gray spots in the subsoil. Grey color in clays indicates prolonged water saturation and possibly a high water table. Some slopes will have channels across a field where water moves in the soil like a subsurface stream. When examining a reddish soil, do not assume that the color indicates a high clay content. Red color often indicates iron content without directly corresponding to the amount of clay in the soil. Some reddish subsoils are very well-drained while others are poorly-drained clays. With moist soils,

you can roughly estimate clay content by squeezing a ribbon between your fingers. Clayey soils will make a longer and smoother ribbon than loamy soils. The county soil survey can provide a much more exact estimation of soil texture.

**County Soil Survey:** It is helpful to back up visual observations of the soil and landscape changes with the descriptions from your county soil survey. Find the field location on the soil maps. Note the changes in soil type that occur within the site. Soil types often follow changes in aspect and/or slope. Note the range in clay content. Those areas in a field that represent the high end of clay content could be more problematic. Read each soil class description, paying particular note to the different management guidelines for each type. The level of disturbance that a soil can sustain at a particular slope will vary widely for different soil types. Fraser fir is much more sensitive to changes in clay content and moisture than the major crops discussed in most soil surveys.

**Pest Considerations:** While one is evaluating soils and landscape of a site it is important to also remember to look for existing pest problems. If it is summer or early fall, most weeds will be mature and easy to identify. Such information can be used to direct future weed management strategies. Summer and fall are also seasons when the presence of grubs can be evaluated. Recommended monitoring involves sifting through soil from five cubic foot deep holes across a field. Checking old pastures prior to planting can allow a grower to implement a control strategy before transplants are damaged. One other pest that can occasionally damage new plantings is the pales weevil. If mature pines are being harvested close-by the summer or fall before Christmas trees are to be set, a migration of weevils can occur. The weevils will feed on the stems of Christmas trees of all sizes, but their damage can kill young trees. These scenarios indicate that even during initial site evaluation, pest management is a critical concern.

**Management Considerations:** All of the site factors that affect Fraser fir growth must be met, but several management issues should be considered as well. The site should fit the intended scale of production. Equipment must be able to function for the field size, turnout areas, and terrain. Farm location, road accessibility, and harvest-season access are critical to keeping production costs low. The cost of additional road construction can be a major ongoing expense and drawback for some sites. Multiple access points and limited visibility

can encourage equipment and tree theft. If neighbors are close to the property line, pesticide use or other activities can become points of conflict. Many of these management factors could be handled on a good production site, but they can tip the balance against sites with marginal soils or landscape features.

**Summary:** Site selection for Fraser fir production must involve consideration of a wide range of factors. Each site will have a unique mix of strengths and weaknesses. Factors that contribute to *Phytophthora* root rot are very critical, but production and business management issues must also be considered.

- ◆ Elevations between 3,000 and 4,500 feet provide a target range where optimum climate and soil conditions can be found. Higher elevation sites have exposure and accessibility problems. Lower elevation sites may have tight soils with too much clay and be too hot for optimum Fraser fir growth.
- ◆ Aspect (the direction which a field faces) is particularly important on low-elevation sites. South- and southwest-facing sites have higher soil temperatures and often a higher clay content than other aspects at the same elevation. On marginal sites, southern aspects may aggravate survival and growth problems.
- ◆ Landscape or topography can indicate small changes in drainage that can predispose an area to *Phytophthora* root rot. Drainage areas, dips, or depressions in fields should not be planted in Fraser fir. Changes in aspect, slope, or vegetation can indicate changes in soil type. Also note shaded areas and potential frost pockets.
- ◆ Moderate slopes do not guarantee a good site. Well-drained sites depend on both good internal soil drainage and movement of water down the slope. Look beyond slope to soil characteristics and landscape position.
- ◆ Soil testing provides vital information for current nutrient status and corrective nutrient applications needed to optimize growth.
- ◆ Depth of topsoil and subsoil can indicate much about the productivity of a site. Shallow soils (20 inches or less to bedrock) have less water and nutrients during droughts, too much water during wet spells, and no reserve of topsoil to lose to erosion or compaction.

- ◆ Examining the soil profile with a soil auger can indicate potential rockiness, plow pans, clay layers, or drainage problems. **If there are major problems in the subsoil, no amount of tillage, subsoiling, or fertilizer will improve the site for the life of a Fraser fir.**
- ◆ Soil color can identify certain site characteristics. Dark subsoils tend to be more fertile than light subsoils. Grey mottling indicates poor drainage. Red color indicates iron, not clay.
- ◆ Use maps and soil class descriptions in the county soil survey to support field observations.
- ◆ Look at the site with pest management in mind and monitor for weeds and grubs.

- ◆ Business, logistics, and management factors must be considered in selecting a site, but Fraser fir growth factors are paramount.

#### **Critical Tools for Fraser Fir Site Evaluation**

- ◆ County soil survey
- ◆ Soil test report
- ◆ Soil sampling tube, bucket to take samples and soil sample boxes
- ◆ Soil auger or shovel to evaluate subsoil
- ◆ Shovel to sample for grubs

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Prepared by Jeffery H. Owen, Area Forestry Extension Specialist, Christmas Trees, College of Natural Resources  
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