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# GREAT LAKES

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interplanting vs. block planting  
& fraser firs



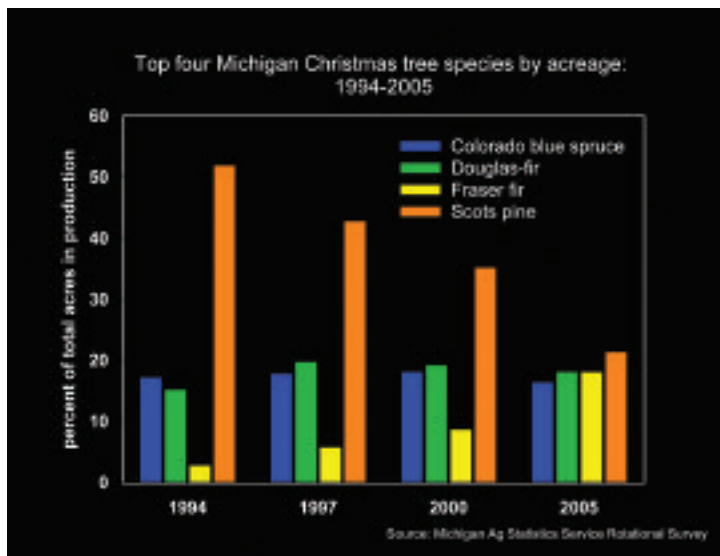
## Christmas Tree Species Profile: Fraser fir (*Abies fraseri*)

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In this edition of *Christmas Tree Species Profiles* we turn our attention to Fraser fir (*Abies fraseri*), one of the most important conifers for Christmas tree production in Michigan and the United States.

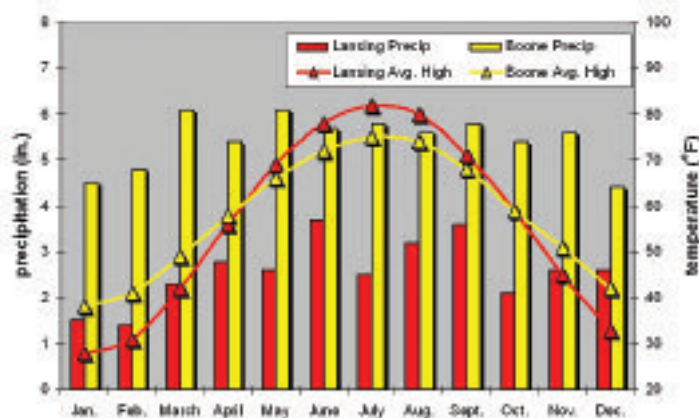


New markets on the horizon. Production of table-top Fraser fir Christmas trees at Dutchman tree farms, Manton, Michigan.



Production of Fraser fir in Michigan has grown rapidly in since 1994.

### Climate Comparison: Mid-Michigan vs. Western North Carolina



Mid-Michigan (Lansing) is warmer during the summer and receives about half the rain-fall as the native range of Fraser fir (Boone, NC)

Fraser fir ranks in the top four leading Christmas tree species in Michigan along with Colorado blue spruce (*Picea pungens*), Douglas-fir (*Pseudotsuga menziesii*) and Scots pine (*Pinus sylvestris*). The ascendance of Fraser fir in Michigan is impressive considering the species accounted for less than 3 percent of Christmas tree acreage in Michigan in 1994. Consumer preference for Fraser fir is high because of its outstanding form, superior needle retention, blue-green to silvery-green color, and attractive scent. As a result, wholesale prices of Fraser fir are nearly double those of Scots pine and growers have increased production of Fraser fir, largely at the expense of Scots pine.

#### Range & Distribution

Fraser fir is native to a small region at high elevations of the Appalachian Mountains in southwestern Virginia, western North Carolina, and eastern Tennessee. The region is characterized

by mild summer and winter temperatures and frequent precipitation. Elevations in the Fraser fir range average around 5,000 ft above sea level with annual precipitation rates between 75 and 100 inches and summer temperatures averaging 59°F. There are also a considerable number of days (65%) with fog cover, adding a cooling effect and contributing to precipitation totals due to fog drip. Fraser fir naturally grows in regions with shallow and rocky mineral soils. These soils tend to be very acidic with a pH range of 3.8 to 4.2. Rooting of Fraser fir is often shallow but may vary depending on the depth of soil present. Within its native range natural stands of Fraser fir are declining due to infestations of balsam wooly adelgid. There is also concern that air pollution in the southern Appalachians is contributing to the species' decline. Ecologists are particularly concerned with poor reproduction and seedling survival in native stands, which may threaten to eliminate some populations.

#### Taxonomy

The name *Abies fraseri* (Pursh) Poir comes from a history of several botanists' reports and discoveries of the species. In 1787 French botanist Andre Michaux and Scottish botanist John Fraser set out on a journey through the Carolinas. Fraser eventually separated from Michaux and later discovered an unknown species of fir and was later credited for his discovery. Frederick Traugott Pursh, a German botanist who immigrated to the United States, reported on Fraser fir in his book "A systematic Arrangement and Description of The Plants of North America" which was published in 1813. Years later a French botanist Jean Louis Marie Poiré, described Fraser fir and other plant species in a series of publications known as *Encyclopedie methodique botanique*.

Within the genus *Abies*, Fraser fir is classified in the section *Balsamea*, with *A. koreana*, *A. vetchii* and *A. sachalinensis* among the most closely related

# fraser fir

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**Native populations of Fraser fir in the southern Appalachians are threatened by balsam wooly adelgid, air pollution, and poor natural regeneration.**



**Grown out of its native range, in this case in western Oregon, Fraser fir may produce large cone crops at an early age.**

species. In the southern Appalachians, Fraser fir occurs in six separate populations; Great Smokey Mountains National Park, Roan Mountain, Grandfather Mountain, Mt. Rogers, Black Mountains, and Balsam Mountains. North Carolina State University geneticist John Frampton recently completed a comprehensive study of genetic variation in Fraser fir for Christmas trees. Frampton found that growth and USDA Christmas tree grade varied not only among provenances but also among families within provenances of Fraser fir. In fact, variation in Christmas tree traits was greater within provenances than between them. This is significant for the Fraser fir industry in the Great Lakes region because it suggests genetic improvement may be possible by developing land races through selection and testing of parent trees from existing plantations, regardless of their geographic origins.

## Management considerations

A complete description of management of Fraser fir for Christmas tree production is beyond the scope of this brief

species profile, however Fraser fir presents several noteworthy challenges for growers. These management challenges are largely related to the ecological characteristics of the species based on the relative small native range in which it has evolved. As noted earlier, Fraser fir is adapted to growing under well-drained, acidic soils, with ample rainfall and summer fog. These conditions rarely occur simultaneously in Michigan. In order to grow high-quality Fraser fir Christmas trees, growers in Michigan need to recreate, as best they can, the species' native environment.

In order to successfully produce Fraser fir, growers must have a thorough assessment of their soils. Soil pH, soil texture, and soil drainage are all critical to Fraser fir. MSU Forest Ecologists David Rothstein and Nicholas Lisuzzo surveyed soil properties, tree growth, foliar nutrition and needle color in Fraser fir plantations throughout Michigan. They determined that soil pH is the key factor limiting development of Fraser fir in Michigan. As soil pH increases, uptake of elements such as manganese and phosphorus can

decline causing tree trees to become increasingly chlorotic. Growers can reduce soil pH by fertilizing with ammonium sulfate on loamy soils; however, the relative ability to affect soil pH decreases as soil texture becomes heavier.

In addition to differences in soil properties between Michigan and western North Carolina, rainfall and temperature patterns also vary between Michigan and Fraser fir's native range. Using Lansing, MI and Boone, NC as representative locales we see that mid-Michigan receives about half the rainfall of western North Carolina. Also, high temperatures during midsummer average about 4 degrees warmer in Michigan. These differences in climate point out the need for irrigation to insure good seedling survival and maintain adequate growth of Fraser fir.

Variation in environmental conditions between Michigan and the native range of Fraser fir also underlies the problem of precocious coning in Fraser fir. In its native environment Fraser fir, like most firs, is a relatively poor cone producer. In fact, delayed flowering or poor cone production are major bottlenecks in many





**Although Fraser fir is not native to Michigan, it is well adapted to Michigan winters.**



**Producing quality Fraser fir requires careful attention to site selection, pest management, irrigation, and plant nutrition.**

conifer tree improvement programs, including Fraser fir in North Carolina. Heavy coning of Fraser fir when grown as an exotic appears to be primarily related to increased water stress. For example, in western Oregon, which receives less than 5" of rain on average from June through August, Fraser fir produces copious amounts of cones in Christmas tree plantations. In Michigan, growers report that Fraser fir may produce heavy cone crops even under irrigation. This phenomenon may reflect the high sensitivity of the species to atmospheric drought stress as well as soil moisture availability. William Smith at Duke University has studied the problem of Fraser fir seedling recruitment in native stands and noted that Fraser fir is highly sensitive to changes in atmospheric humidity deficit.

### **Pests**

Fraser fir is subject to several serious pest problems including balsam twig aphid, spruce spider mites, and phytophthora root rot; though most are manageable for conscientious growers. For a comprehensive overview of pests of

Fraser fir consult the Christmas Tree Pest Manual (MSU Extension Bulletin E-2676 <http://www.na.fs.fed.us/spfo/pubs/misc/xmastree/>). MSU Extension Statewide Christmas Tree Educator Jill O'Donnell, MSU Entomology Specialist Deb McCullough and Pathology Specialist Dennis Fullbright highlight current and emerging pests problems each week during the growing season in the MSU Nursery and Landscape Crop Advisory Team (CAT) Alert newsletter (<http://www.ipm.msu.edu/aboutcat.htm>) or type 'MSU Nursery CAT Alert' in your favorite search engine.

### **Future of Fraser fir**

In a relatively short time Fraser fir has become firmly entrenched as a major Christmas tree species in the Great lakes region. Soil factors, particularly heavy soils that do not drain well and are resistant to changes in pH, are the largest limiting factors for expanding Fraser fir production. Growers that are considering growing or increasing Fraser fir production need to thoroughly assess their soils before initiating new plantations.

Growers also need to carefully assess the availability of irrigation sources if they are planning to irrigate. Pest management may also become increasingly challenging as chemical costs increase and environmental regulations become more restrictive. Innovative means of controlling pests, including weeds, are being investigated. For example, at North Carolina State University researchers have developed an approach termed 'chemical mowing', which uses low rates of glyphosate to eliminate aggressive weeds such as grasses and promotes more crop-friendly weeds such as nitrogen fixing clovers. Closer to home, Dr. Pascal Nzokou and his graduate students at MSU are examining the feasibility of cover crop management to reduce weed pressure and improve soil health in Christmas tree plantations. While sustainability is quickly becoming another buzzword in some circles, it is clear that future challenges in producing Fraser fir profitably in the Great Lakes region lies in managing this exotic species while reducing inputs.

**Living Christmas trees. Graduate Research Assistant Wendy Klooster displays a container-grown Fraser fir in the MSU Pot-in-Pot Research Nursery.**



Growers of Bareroot

-Fir

-Spruce

-Pine

-White Cedar

Seedlings and Transplants



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