The Longleaf Alliance

7th Regional Conference and Forest Guild Annual Meeting

Forestry in a Changing World: New Challenges and Opportunities

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Report No. 14

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Surfing the Koehler Curve: Revisiting a Method for the Identification of Longleaf Pine Stumps and Logs

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Abstract
Measurements of pith and second growth ring diameters were used by Koehler in 1932 to separate longleaf pine (Pinus palustris Mill.) timbers from those of several southern pines (e.g., loblolly, shortleaf). In the current study, measurements were taken from plantation-grown longleaf, loblolly and shortleaf pine trees, as well as old growth longleaf pine, lightwood, and turpentine stumps, to evaluate the method. Results presented here demonstrate that the Koehler method provides an effective means to identify longleaf pine timbers and stumps with applications in the conservation and forest products fields.

Introduction
Turpentine stumps have been discovered in Caroline County, central Virginia, outside the historical range for longleaf pine in southeastern Virginia (Figure 1). Longleaf pine is very rare in Virginia and the ability to correctly identify the taxon of these stumps, and nearby lightwood stumps, would assist conservation biologists with their longleaf pine restoration efforts. A method for longleaf pine timber identification was developed by Koehler (1932). We revisited this technique to determine its robustness and to assess its potential for the possible identification of the above-mentioned turpentine and lightwood stumps as longleaf pine. Confirmation of longleaf pine requires a pith diameter of at least 2.0 mm and successful plotting of the second annual ring measurement above the Koehler curve. Measurements must be made at stump height. An additional benefit of the Koehler method, once validated, is that it could be used to authenticate the identity of salvaged old growth timbers harvested from river bottoms.

Materials and Methods
The Koehler method of identification involves the measurement of pith and second growth ring diameters at stump height. Points appearing above the curve are consistent with longleaf pine whereas those below the curve are likely from one of the other southern pines (Figure 2). Any pith measurement under 2 mm does not belong to longleaf pine and so the measurement of the second growth ring is unnecessary.

Using a digital caliper, measurements were taken from disks cut from plantation-grown longleaf, loblolly and shortleaf pine trees in several southeastern states (Arkansas, Mississippi, Louisiana, South Carolina) and old growth longleaf pine, lightwood, and turpentine stumps in Virginia. Fine sandpaper was used as necessary to smooth the surface of each tree section near the pith to better identify pith edges. Elliptical growth rings were addressed by using an average of the maximum and minimum diameters.

Results and Discussion
All of our longleaf pine measurements fit above the curve delimited by Koehler thus identifying them as longleaf pine and suggesting that a false negative identification of longleaf pine timbers with the Koehler method is highly unlikely (Figure 3). The central Virginia turpentine stump was identified as not belonging to longleaf pine and did not support a range extension for longleaf pine into Caroline County, Virginia. One loblolly pine specimen was plotted as longleaf pine on the Koehler plot giving us a 3% error rate for a false positive longleaf pine identification of a non-longleaf pine timber. Koehler had false positive longleaf pine identification error rates of 3% for shortleaf pine (n=112), 2% for loblolly pine (n=50), and 4% for slash pine (n=82). All of Koehler's longleaf pine samples (n=505), save one with a deformed pith, plotted out as longleaf pine on the Koehler curve. Our measurements therefore validate the work of Koehler and demonstrate that longleaf pine timbers and stumps can be successfully identified with a potential false positive error rate of 2-4%. The method requires that measurements be made at stump height since this captures the unique coarse shoots of the grass and rocket stage of longleaf pine manifested in the large pith in the wood specimen (Fig. 4). Distorted pith may present measurement problems and one must be careful to avoid measuring false rings.

Conclusion
All longleaf pine timber and stump measurements clustered in the zone identified by Koehler as confirming longleaf pine while only one non-longleaf timber barely crossed the curve into the longleaf pine zone. Thus, a false negative assignment of longleaf pine as belonging to any of the other southern pines was shown to be highly unlikely. Koehler noted that other southern pines can rarely be erroneously identified as belonging to longleaf pine (false positive). However, the margin of error for a false positive is less than 5% and well within accepted error rates in the biological sciences. The Koehler method is therefore an effective means of identifying longleaf pine timbers and stumps with applications in the conservation and forest products fields.

Reference
Koehler, A. 1932. The Identification of Longleaf Pine Timbers, The Southern Lumberman, Volume 145, Pages 36-37.

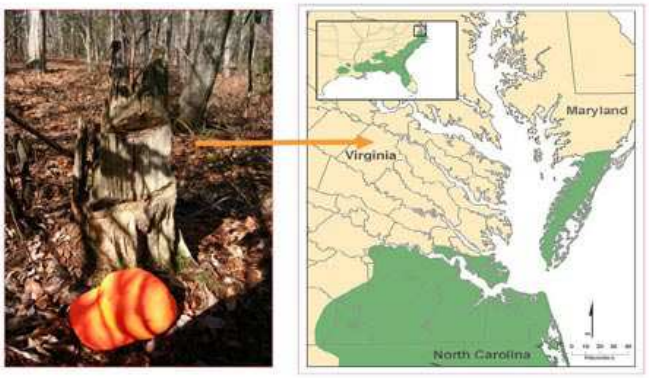

Figure 1. Caroline County turpentine stump and its location in relation to the historical range (shaded area) of longleaf pine in Virginia.

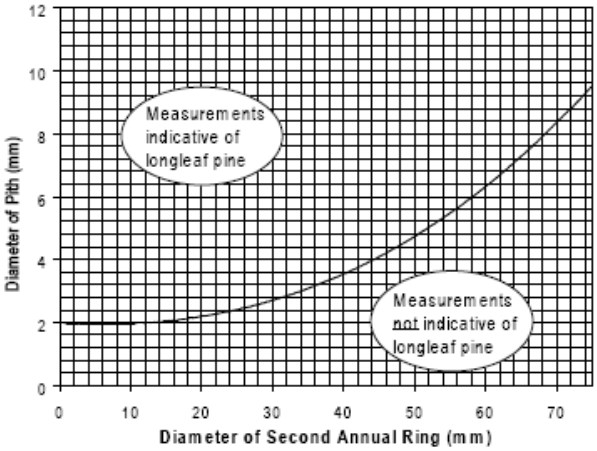

Figure 2. Koehler's plot for identifying longleaf pine timbers.

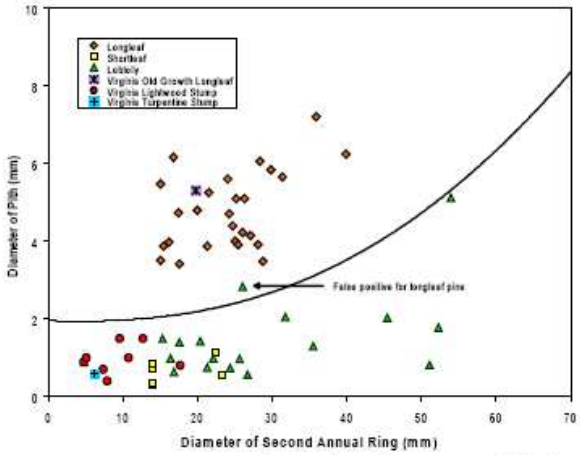

Figure 3. Measurements from plantation-grown loblolly, slash and longleaf pines along with old growth longleaf, lightwood and turpentine stump specimens.

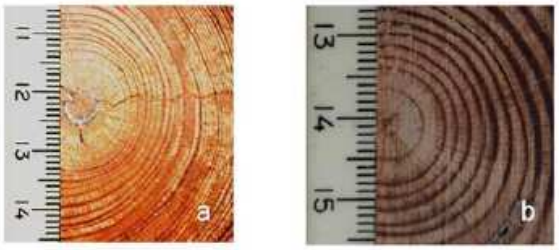

Figure 4. Longleaf pine (a) has a much larger pith (over 2 mm) than other southern pines (b) at stump height.