



## A SIMPLE CASE FOR THE TERM “TOLERANCE”

**A Revised Tolerance Table.** Frederick S. Baker. 1949. *Journal of Forestry* 47(3):179–181.

Tolerance is a widely accepted concept in modern forestry and is a key factor in prescribing silvicultural treatments. However, in the early 1900s tolerance was not so easily part of the silvicultural lexicon. Frederick Baker’s article “A Revised Tolerance Table,” published in 1949 in the *Journal of Forestry*, changed that and made practicing foresters and scientists alike comfortable with the term. Despite its innocuous title, this article hypothesized an acceptable context for the term tolerance and supported that hypothesis with a tolerance table based on surveys of university and USDA Forest Service Experiment Station foresters. This article is significant because vigorous criticism of the term over the previous 30 years had caused many to abandon its use.

One of the first problems to be addressed by the newly created Society of American Foresters (SAF) was determining the physiological mechanisms that allowed a species to grow under the cover of an existing forest canopy. In the July 1907 issue of volume II of the *Proceedings of the Society of American Foresters*, Raphael Zon, a Russian who immigrated to the United States in 1898, attempted to summarize the problems that Europeans were having trying to identify the causal mechanisms of tolerance. He described tolerance as the manifestation of many factors and then described experiments where the apparent tolerance of a tree could be changed by manipulating soil water availability by cutting the roots of competing trees. Zon had included experiments that were conducted in open conditions to support his position. He also argued that prominent features in leaves such as thickness, width, and palisade thickness favored water conservation at the expense of photosynthesis. Herbert A. Smith was quick to respond. In volume III of the *Proceedings* published the following year (1908), he reminded the Society that tolerance was the ability of trees to thrive under an existing forest cover, not out in the open, and he countered Mr. Zon’s interpretation of leaf anatomy by describing how chloroplasts were redistributed in shade leaves—a feature more consistent with maintaining photosynthesis than conserving water. He was forceful in his criticism of water availability as the key factor in tolerance, and he apologized to Zon at the outset of his presentation for the tone of his response.

The seemingly “official” definition of tolerance continued to be the ability to endure shade. Zon even appeared to acquiesce when he and Henry S. Graves published a 59-page Forest Service Bulletin in 1911 titled, “Light in Relation to Tree Growth,” wherein a table listed species according to tolerance to shade. In 1917, an ad hoc SAF

committee on terminology published its report in the *Journal of Forestry* with tolerance defined as the capacity of a tree to endure shade. Understandably, this definition continued to be criticized, because a single factor cannot account for the presence or absence of every case of a species growing in the shade of a forest overstory. Burns (1916) found shade light itself beyond meaningful characterization because of its wide variation; if shade cannot be quantified, how could it be used to categorize a species’ tolerance to it? In the first point of his conclusions he stated, “The word ‘tolerance’ should be stricken from the vocabulary of forestry students unless it can be accorded a more comprehensive definition.” James W. Toumey used nine pages to discuss tolerance in his 1928 textbook, *Foundations of Silviculture*. Regarding the definition of tolerance, he said that “It varies not only with the climate and altitude, but very markedly with soil moisture, soil temperature, soil nutrients, and other factors as well, of which light is only one.” Shirley (1943) recognized the multidimensional nature of tree survival under a forest canopy, but also dismissed Toumey’s revised definition as having no practical value. His suggested path “out of this morass of inconsistencies” was to include a qualifier to the term tolerance: e.g., shade tolerance was the ability to survive in low light intensities, and drought tolerance was the ability to endure water deficits; tolerance used alone should be stopped. SAF changed the definition of tolerance in its 1944 revision of forestry terminology to include the shade and competition created by an overstory.

The term was avoided for its apparent lack of scientific basis until Baker’s 1949 article cleared a way out of Shirley’s morass. Baker simply indicated that tolerance was nothing more than a means for broadly categorizing a species’ reaction to shade, and though it defied rigorous definition, it, like “many good words of the English language . . . could lead useful, picturesque hard working lives.” He made his point with the analogy of the broad categories for age: young, middle-aged, and old; none can be rigorously defined, yet they convey meaning. General agreement among forestry professionals concerning the tolerance rankings of a list of species supported his thesis. By placing the term in its proper context, this three-page article seemed to quell half a century of controversy. *The Dictionary of Forestry* (Helms 1998) published by SAF carried forward the 1944 definition of tolerance in relation to silviculture. Baker’s article has been cited 352 times, according to Google Scholar, and although attributes of tolerance are still investigated, the concept of tolerance is now well embedded in forestry.

## Literature Cited

BAKER, F.S. 1949. A revised tolerance table. *J. For.* 47(3):179–181.

- BURNS, G.P. 1916. *Studies in tolerance of New England forest trees. III. Discontinuous light in forests*. Vermont Agric. Exp. Stn. Bull. 193. 27 p.
- HELMS, J.A. (ED.). 1998. *The dictionary of forestry*. Society of American Foresters, Bethesda, MD. 210 p.
- SHIRLEY, H.L. 1943. Is tolerance the capacity to endure shade? *J. For.* 41(5):339–345.
- SMITH, H.A. 1908. Some further considerations regarding the tolerance and intolerance of shade. *Proc. Soc. Am. For.* 3(1):3–17.
- SOCIETY OF AMERICAN FORESTERS. 1917. Forest terminology—Report of committee. *J. For.* 15(1):68–101.
- SOCIETY OF AMERICAN FORESTERS. 1944. *Forestry terminology: A glossary of technical terms used in forestry*. Society of American Foresters, Washington, DC. 84 p.
- TOUMEY, J.W. 1928. *Foundations of silviculture upon an ecological basis*, Vol 1. John Wiley and Sons, New York. 438 p.
- ZON, R. 1907. A new explanation of the tolerance and intolerance of trees. *Proc. Soc. Am. For.* 2(3):79–94.
- ZON, R., AND H.S. GRAVES. 1911. *Light in relation to tree growth*. USDA For. Serv. Bull. 92. 59 p.

---

*Thomas J. Dean (fwdean@lsu.edu) is professor, Louisiana State University Agricultural Center, School of Renewable Natural Resources, Baton Rouge, LA 70803.*