

Ritchie G A & Hinckley T M. The pressure chamber as an instrument for ecological research. *Advan. Ecol. Res.* 9:165-253, 1975.

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In this review of the pressure chamber technique for measuring plant water potential, we present a brief theoretical framework followed by a critique of methodology, a summary of ecological and other applications, and a discussion of several unresolved questions regarding this method of plant water potential measurement. [The SC<sup>1</sup>® indicates that this paper has been cited in over 250 publications.]

## Ready, Fire, Aim!

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Rapid advances in scientific knowledge often follow major breakthroughs in methodology. Such was the case during the late 1960s in the field of plant-water relations. The key to modeling water movement into, out of, and within plants lies in understanding the thermodynamic properties of the various components of the water milieu within the soil-plant-atmosphere continuum. The chemical potential of water (referred to as water potential) is central among these properties.

Plant water potential had been extremely difficult to estimate until 1964 when P.F. Scholander, H.T. Hammel,<sup>1</sup> and colleagues introduced an ingenious, portable measuring device called a "pressure chamber." The pressure chamber was a dream come true to those of us who had toiled with the tedious measurement methods of the day. Its value was particularly great for field ecologists and ecophysiologicals who could now obtain rapid estimates of plant water potential *in situ*.

However, the robustness of the technique led to its misuse by undisciplined researchers. Terminology was confused, calibration was often inappropriate or even neglected, and

methodology was sometimes sloppy. More importantly, a theoretical framework for developing meaningful measurement strategies was lacking. In a word, many researchers were firing before taking aim.

This was the scene that Tom Hinckley and I witnessed during our waning days as graduate students at the University of Washington in Seattle. We had often discussed the possibility of developing a critical article on this subject but the press of our dissertation work had precluded any such effort. After receiving our PhDs in 1971, Tom went off to an assistant professorship at the University of Missouri, while I, being somewhat less fortunate, went off to two years active duty in the US Army. Sometime during that period (I don't recall exactly when), I was contacted by Dr. Ian MacFadyen, new editor of *Advances in Ecological Research*, asking if I would prepare a review paper on field methods of measuring photosynthesis. This was a subject in which I had little expertise and even less interest. So I countered with an offer to prepare a review paper on proper use of the pressure chamber technique in ecological research. He agreed and I began writing.

Very fortunately for me, Tom found out about my effort and, with characteristic energy and helpfulness, he offered to assist in any way he could. And assist he did. He provided dozens of photocopied references, prepared all the figures, contacted and solicited invaluable input from nearly 50 coworkers from around the world, and provided extensive editing services. Meanwhile, isolated from academia, I labored over my Smith Corona in my bachelor officer quarters for nearly two years grinding out this tome. The final work on the paper was done after my Army service ended and I joined Weyerhaeuser Company as a researcher in forest ecology in 1973.

The paper has stood the test of time. A recent review<sup>2</sup> concedes that not a great deal can be added to our initial synthesis in 1975. Its popularity no doubt has piggybacked the popularity of the elegant device for which it has served as a sort of "User's Guide" for nearly 15 years.

1. Scholander P F, Hammel H T, Bradstreet E D & Hemmingson E A. Sap pressure in vascular plants. *Science* 148:339-46, 1965. (Cited 1,145 times.)
2. Turner N C. Measurement of plant water status by the pressure chamber technique. *Irrig. Sci.* 9:289-308, 1988.