THE RESEARCH CONTRIBUTIONS OF DR. PAUL VAN DEUSEN

Thomas B. Lynch, Francis A. Roesch, John Paul McTague, Jeffrey H. Gove, Gregory A. Reams, and Aaron R. Weiskittel[1]

Abstract—Dr. Paul Van Deusen's recent passing concluded a rich 30+-year research career dedicated to development and implementation of quantitative methods for forestry and natural resources. Since the early part of his career as a biometrician with the USDA Forest Service Southern Research Station in the 1980s-1990s and continuing with his later employment at NCASI, Dr. Van Deusen has made many research contributions that have been directly or indirectly important for the implementation of FIA data collection methods and for the analysis and interpretation of FIA data. We have attempted to summarize highlights of Dr. Van Deusen's contributions to FIA and to forestry, as well as natural resources in general.

On August 21, 2015 the forestry profession lost Dr. Paul Van Deusen, a generational science leader in applying quantitative sciences to the contemporary issues of each decade of his career. Paul's knowledge and practical applications of forest biometrics were uniquely multi-dimensional as this paper chronicles. In the mid-to-late 1990s Paul worked with the Forest Service's Forest Inventory and Analysis (FIA) program, and inventory experts and users of FIA's partner and user community in defining the statistical design and estimation techniques for FIA's annual forest inventory. Paul was a rare combination of theory and practicality and an ardent student of Occam's razor or 'law of parsimony' and the current annual FIA panel design is a direct reflection of this principle. Dr. Van Deusen was a founding member of the first FIA science symposium held in November of 1999 in San Antonio, Texas. He continued to work closely with the FIA science and user community and was a member of the planning committee for this symposium, the 12th FIA science symposium. He also worked tirelessly with the organizing committee of each and every Annual National FIA User's Group Meeting sponsored by the Society of American Foresters over the last two decades. We dedicate this symposium to Dr. Paul Van Deusen and invite you to read this tribute to Paul's research contributions.

EARLY YEARS AND THE SOUTHERN STATION

Dr. Paul Van Deusen received his Ph.D. from the University of California, Berkeley under the direction of Dr. Gregory Biging, where he also interacted with Dr. Lee Wensel who was then developing the CACTOS growth model for California forests. Paul's doctoral work contributed to the stand generator for CACTOS (Van Deusen 1984; Van Deusen and Biging 1984; Biging et al. 1994). Previously, he received an M.S. from Mississippi State University working with Drs. Thomas Matney and Al Sullivan, where among other projects they published early south-wide individual tree volume equations for loblolly pine (Van Deusen et al. 1981) and a system of equations for predicting volume and diameter of sweetgum trees to any height (Van Deusen et al. 1982). Prior to his M.S., Paul earned a B.S. in forest management from the University of Massachusetts. After leaving

[1] Professor (TBL), Department of Natural Resource Ecology and Management, Oklahoma State University, Stillwater, OK 74078; Research Mathematical Statistician (FAR), USDA Forest Service Southern Research Station, 200 W.T. Weaver Blvd, Asheville, NC 28804; Biometrician (JPM), Rayonier, Inc., PO Box 819, Yulee, FL 32041; Research Forester (JHG), USDA Forest Service Northern Research Station, 271 Mast Road, Durham, NH 03824; National Program Leader, FIA (GAR), USDA Forest Service, Research and Development National Office, 1400 Independence Ave. SW, Washington D.C. 20250; Associate Professor (ARW), School of Forest Resources, University of Maine, 229 Nutting Hall Orono, ME 04469. TBL is corresponding author: to contact, call (405) 744-5447 or email at tom.lynch@okstate.edu

Berkeley, Paul was employed by the Institute of Quantitative Studies unit in the USDA Forest Service Southern Research Station at New Orleans, LA headed by Project Leader Dr. Tommy Dell. The unit in those days had responsibility for technical aspects of the southern FIA (then termed Forest Survey) and Dr. Van Deusen developed a keen interest in forest sampling problems.

Dr. Van Deusen was one of the early contributors to the application of Monte Carlo Integration to forest sampling problems. With Dr. Walter Meerschaert, he published a paper proving that critical height sampling was unbiased for any tree taper function using the framework provided by the cylindrical shells integral (Van Deusen and Meershaert, 1986). By remarkable coincidence, Lynch (1986) published a paper in a different journal taking a very similar approach to critical height sampling independently of Dr. Van Deusen's work. With Lynch, Dr. Van Deusen was the first to apply the variance reduction technique of antithetic variates to obtain unbiased estimates of tree volume (Van Deusen and Lynch 1987), combining the technique with importance sampling that had previously been introduced into forestry by Gregoire et al. shortly prior (Gregoire et al. 1985, 1986; and Furnival et al. 1986). Importance sampling was originally developed to reduce the number of computer operations needed in Monte Carlo analyses (Kahn and Marshall, 1953). Dr. Van Deusen (1987a, 1990a) was also the first to apply the control variates technique often used for variance reduction in Monte Carlo integration to the unbiased estimation of tree stem volume. At about the same time, Van Deusen (1987c) discussed design versus model-based estimates in reference to 3-P sampling and Van Deusen (1988) investigated simultaneous estimation with a squared error loss function. Dr. Van Deusen (1995a) later proposed difference sampling as an alternative to importance sampling. Since that time antithetic variates and control variates have had other applications in forest sampling and promise to remain part of the "tool kit" in forest sampling for the foreseeable future.

During the 1980s, the potential effects of acid rain on forest growth became an issue of interest, and Dr. Van Deusen made several contributions in this area. He made a pioneering application of the Kalman filter in dendrochronology by applying it to increment core data, which were being used to study possible effects of acid rain on tree growth (Van Deusen 1987b, 1988, 1989a, 1990b,c). Although Visser (1986) published an application of the Kalman filter to tree ring data slightly earlier, Van Deusen (1987b, 1988) had formulated it independently before the Visser (1986) paper was published. While at Berkley he had taken a course from Dr. Andrew Harvey, econometrician and expert on Kalman filtering. Dr. Van Deusen also supervised work on a project to study increment cores obtained with probability proportional to size sampling on point samples, which in that era were used by the southern FIA (formerly called "Forest Survey"). As part of that project, Drs. Juha Lappi and Robert Bailey quantified bias in growth estimates due to collection of increment cores on point samples (Lappi and Bailey 1987). Due to the sampling method, trees with cores showing faster growth also had larger inclusion zones and were more likely to be sampled than other trees of a given initial size a fixed number of years previous. Lynch also worked on the project and proposed ratio estimators to correct the problems, testing these in simulations (Lynch and Huebschmann 1992). Dr. Van Deusen (1986) also obtained likelihood equations for fitting tree diameter distributions (e.g, the Weibull distribution) when sample trees were selected from point samples. Another contribution to point sampling research included estimators for point clusters (Van Deusen and Grender 1989). Van Deusen and Baldwin (1993) proposed methods of sampling and predicting tree dry weight. Van Deusen (1992) discussed growth dynamics for naturally-occurring loblolly pine in the south. The recurrence of slash pine blight was analyzed by Van Duesen and Snow (1991). In an extension of his tree-ring research, Dr. Van Deusen collaborated on the use of data to detect large-scale disturbances in Reams and Van Deusen (1993), the standardization of tree-ring data in Van Deusen and Reams (1993), and on historic climatic variation in Reams and Van Deusen (1998).

Obtaining compatible estimates of the components for forest growth from remeasured point samples or from partial replacement sampling was an issue of interest during Dr. Van Deusen's tenure with the Southern Station, especially since the FIA plots at the time were point samples. Dr. Van Deusen made several contributions in this area. Significant papers by Dr. Van Deusen that focused on improved estimation included Van Deusen et al. (1986), Van Deusen (1993, 1996a, 1999a), and Roesch and Van Deusen (1993). As indicated above, Dr. Van Deusen had taken econometrics coursework at Berkeley during his Ph.D. studies and was aware of generalized least squares as used by econometricians. He realized that generalized least squares could be applied to the forest inventory problem of obtaining compatible estimates of forest growth from remeasured point samples and partial replacement data. He developed a framework that included partial replacement sampling and achieved partial compatibility for estimates of the components of growth using remeasured point or plot sample data (Van Deusen 1989b). Subsequently, Lynch (1995) applied restricted generalized least squares in a similar framework to achieve exact equality between growth component estimators. Van Deusen later applied generalized least squares to obtain one of the early estimators for the annual FIA system, which was new at that time (the mid or later 1990s). This estimator allowed specification of a restriction that could be varied in strength from exact to approximate. The generalized least squares framework remains an important approach to the analysis of FIA and other large forest inventory datasets.

In 1997, Dr. Van Deusen proposed the technique of multiple imputation for annual forest inventory applications, which had previously been used by statisticians working in other fields. Since then, the method has been widely used to supply missing data in forestry datasets and to develop tree lists for forest growth simulators among other applications. Although single imputation had been applied in the Swedish National Survey (Holm et al. 1979, Ranneby et al. 1987) and the Finnish forest survey (Poso 1978), and Moeur and Stage (1995) had proposed nearest neighbor methods, Van Deusen's (1997) application of multiple imputation to natural resource data was pioneering.

NCASI AND LATER CAREER

After working for the USDA Forest Service Southern Station for a 10 year period, Dr. Van Deusen worked as a biometrician for the National Council for Air and Stream Improvement (NCASI), where his interest in forest sampling and FIA continued. He also developed software for harvest scheduling, among many other endeavors. In the early 1990s, Dr. Van Deusen, focused his research effort into building a multi-objective harvest scheduling program called HABPLAN. HABPLAN can be described as a Model I harvest schedule with an integer formulation that permits the user to obtain solutions that are spatially compliant with adjacency constraints. Paul elected to achieve optimality using the Metropolis heuristic in a methodology that is best described as simulated annealing. Dr. Van Deusen collaborated with others later to use the HABPLAN harvest scheduler for landscape-scale analysis of forestry guidelines using bird habitat models in Loehle et al. (2006). He also constructed an ingenious matrix generator program called HABGEN, and wrote both applications in JAVA. Some of his publications in this area include Van Deusen (1999b) concerning multiple solution harvest scheduling, Van Deusen (2001a) which relates to harvest scheduling with spatial constraints, and Van Deusen (1996b) which applied Bayesian concepts to habitat and harvest scheduling. His collaborations and contributions in habitat modeling and ecology also appear in Wigley et al. (2001), Mitchell et al. (2008), Loehle et al. (2009), Miller et al. (2011), Irwin et al. (2015), Van Deusen and Irwin (2012), Van Deusen et al. (1998) and Van Deusen (2002a). Van Deusen (2010) discussed the evaluation of the option of carbon storage in forests.

In the late 1990's, Dr. Van Deusen was part of a group of scientists and professionals who were a key influence on changing the FIA to the current national annual design from the various regional periodic designs. The implementation of annual inventories by the Forest Inventory and Analysis (FIA) program in the United States initiated entirely new threads of estimation-focused research. It was immediately obvious that the traditional way of thinking about and analyzing remeasured samples was inadequate for the panelized annual sample design. One of the earliest papers on the subject was Van Deusen (1997). The significant implications of the design were discussed in Van Deusen (2000a, 2000b) and Van Deusen et al. (1999). Additional significant research is found in Van Deusen (2001b, 2002b, 2004), on alternative designs and estimators for annual inventories. Spinney et al. (2006) unveiled one of at least three comprehensive on-line estimation tools for FIA data (SOLE). The other two tools are COLE (Proctor et al., 2002; Spinney et al., 2005) and GForest (Spinney and Van Deusen, 2007). With respect to this sample design, many papers offered interesting perspectives on improved estimation. Van Deusen (2005), in an attempt to nudge FIA into choosing more efficient estimation methods, gave an alternative view of some of the issues that led to the existing procedures. Van Deusen (2007a, 2007b) then showed an alternative way for FIA to achieve the long-standing goal of ensuring compatible marginal totals in tables using weighted estimators. Van Deusen and Heath (2010) proposed weighted analysis methods for mapped forest inventory data. The need for estimators that consider the specific timing of the observations from this design was recognized in these and the later publications of Van Deusen and Roesch (2007, 2009a, 2009b, 2013), Roesch and Van Deusen (2010a,b, 2012, 2013), and Van Deusen et al. (2013).

Until his passing, Dr. Van Deusen continued to investigate alternative designs and estimators for special problems in forestry. A notable collaboration with Dr. Jeff Gove started with the problem of sampling downed woody debris and resulted in the "sausage method" of estimation in Gove and Van Deusen (2011) and a general spoked transect discussion in Van Deusen and Gove (2011). Dr. Van Deusen also contributed to the three-dimensional jigsaw-puzzle view of forest monitoring in Roesch and Van Deusen (2013). The utility of the simple systematic well- dispersed sample design, currently used by FIA, that Paul was very instrumental in effecting, is being discovered by many investigators for use in highly specialized studies. Finally, Dr. Van Deusen considered alternate ways of sampling and estimating tree volume, biomass and carbon, which is an issue on which FIA is still working (Van Deusen and Roesch, 2011).

Like many of his contemporaries, Paul also contributed to improving the integration of remotely sensed data and forest inventories. Van Deusen (1994, 1995b) discussed the correction of bias in change estimates from thematic maps. Roesch, Van Deusen, and Zhu (1995) investigated estimators for updating forest area coverage using AVHRR and forest inventory data, while Van Deusen (1996c) gave unbiased estimates of class proportions from thematic maps.

Most biometricians have some talent with and affinity towards computers and the programming thereof. Dr. Van Deusen was no exception in this area; on the contrary he was quite exceptional. He was an early adopter of *nix (i.e., Unix, Linux) computational platforms and was instrumental in converting several colleagues from proprietary systems to Linux. In the nineties, when most people were using PCs or Macs, Dr. Van Deusen was working on Sun Microsystems SPARC-based workstations running Solaris Unix as the operating system. Eventually, in the late 1990s Dr. Van Deusen was drawn to Linux, an open source alternative to Unix, and began building his own computers running Red Hat (and later Fedora) Linux. Dr. Van Deusen was comfortable with a diverse array of programming languages, both closed (on SPARC) and open-source (on Linux). His "Dynaclim" Kalman filtering system (Van Deusen and Kortez, 1988) was written in the Gauss (Aptech Systems) matrix language. The online applications like COLE (Proctor et. al, 2002) developed by Dr. Van Deusen and his staff (at various times including: John Beebe, Patrick Proctor, Mike Spinney, and Rei Hayashi) employed a variety of different open-source languages including perl, Java, JavaScript, Grass, Povray (a ray tracing program, used in GForest for 3D views of individual plots), mySQL (later MariaDB), R, LaTeX (for automated report generation through Sweave in

R) and, of course, HTML. Dr. Van Deusen was an advocate for the Linux and open-source development model (Proctor et. al, 2003) and would often comment that it would have been much more difficult to develop similar online tools on other (i.e., closed) platforms. Dr. Van Deusen's preferred software for everyday work on Linux was a combination of R for analysis and LaTeX for manuscripts. He would joke that he did not know how to use a spreadsheet program.

CONCLUSIONS

The tools mentioned above give testimony to Paul's contributions as a "complete biometrician." Although many of us tend to prefer the theoretical developments of our craft, a complete biometrician gets an idea, develops the theory to express the idea, and then packages the results into a product that is usable by others. Paul was not only adept at simplifying complex ideas to the point where they were understandable to any reader of his publications, he was also extremely adept at developing user-friendly systems to implement those ideas, and he did that in every area of his research.

Unfortunately, Paul passed away on August 21, 2015, but he has left a rich legacy to the forest biometrics community. Dr. Van Deusen remained an active and vibrant scientist until his death, as will be evidenced by his posthumous publications. So far, we know of Roesch et al. (2015). Given the many areas that he had an interest in, we suspect that there are other manuscripts still in process.

ACKNOWLEDGEMENT

Approved by the Director of the Oklahoma Agricultural Experiment Station and supported by Project OKL0-2843.

LITERATURE CITED

Biging, G.S.; Robards, T.A.; Turnblom, E.C.; Van Deusen, P.C. 1994. The predictive models and procedures used in the forest stand generator (STAG). Hilgardia 61(1): 1-36.

Furnival, G.M.; H.T. Valentine; Gregoire, T.G. 1986. Estimation of log volume by importance sampling. Forest Science. 32:1073-1078.

Gove, J.H.; Van Deusen, P.C. 2011. On fixed-area plot sampling for downed coarse woody debris. Forestry 84 (2): 109-117.

Gregoire, T.G.; Valentine, H.T.; Furnival, G.M. 1985. Estimation of volume with a taper function: A sampling approach. In: Use of auxiliary information in natural resource inventories. Society of American Foresters Publication No. SAF 86-01: 164-170

Gregoire, T.G.; Valentine, H.T.; Furnival, G.M. 1986. Estimation of bole volume by importance sampling. Canadian Journal of Forest Research 16:554-557.

Holm, S.; Egglund, B.H.; Marensson, A. 1979. A method for generalization of sample tree data from the Swedish National Forest Survey. Department Forest Survey Swedish University of Agricultural Sciences Rep. 25

Irwin, L.L.; Rock, D.F.; Rock, S.C.; Loehle, C.; Van Deusen, P.C. 2015. Forest ecosystem restoration: Initial response of spotted owls to partial harvesting. Forest Ecology and Management. 354:232-242.

Kahn, H.; Marshall, A.W. 1953. Methods of reducing sample size in Monte Carlo computations. Journal of the Operations Research Society of America. 1:263-278.

Lappi, J.; Bailey, R.L. 1987. Estimation of diameter increment function or other tree relations using angle-count samples. Forest Science. 33(3):725-739.

Loehle ,C.; Van Deusen, P.; Wigley, T.B.; Mitchell, M.S.; Rutzmoser, S.H.; Aggett, J.; Beebe, J.A.; Smith, M.L. 2006. A method for landscape analysis of forestry guidelines using bird habitat models and the Habplan harvest scheduler. Forest Ecology and Management. 232(1–3): 56–67.

Loehle, C.; Wigley, T.B.; Schilling, E.; Tatum, V.; Beebe, J.; Vance, E.; Van Deusen, P.; Weatherford, P. 2009. Achieving conservation goals in managed forests of the Southeastern Coastal Plain. Environmental Management. 44:1136–1148.

Lynch, T.B. 1986. Critical height sampling and volume by cylindrical shells. Forest Science. 32:829-834.

Lynch, T.B. 1995. Compatible estimation of components of forest growth from remeasured point samples with restricted generalized least squares. Forest Science. 41(3):611-628.

Lynch, T.B.; Huebschmann, M.M. 1992. Estimating diameter increment by dbh class with horizontal point sampling. Forest Ecology and Management. 51:285-299.

Miller, D.A.; Stihler, C.W.; Sasse, D.B.; Reynolds, R.; Van Deusen, P.; Castleberry, S.B. 2011. In: Loeb, S.; Lacki, C.; Michael J.; Miller, Darren A.; eds. 2011. Conservation and management of eastern big-eared bats: a symposium. GTR SRS-145. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station: 53-61

Mitchell, M.S.; Reynolds-Hogland, M.J.; Smith, M.L.; Bohall Wood, P.; Beebe, J.A.; Keyser, P.D.; Loehle, C.; Reynolds, C.J.; Van Deusen, P.; White Jr., D. 2008. Projected long-term response of Southeastern birds to forest management. Forest Ecology and Management. 256(11):1884–1896.

Moeur, M.; Stage, A.R. 1995. Most similar neighbor: an improved sampling inference procedure for natural resource planning. Forest Science. 41:337-359.

Poso, S. 1978. National forest inventory in northern Finland. IUFRO Meeting, Subject Group S4.02 on Forest Inventory, Bucharest, Romania.

Proctor, P.; Heath, L.S.; Van Deusen, P.C., Gove, J.H.; Smith, J.E. 2002. COLE: A web-based tool for tnterfacing with forest Inventory data. In: 2002 Proceedings of the Fourth Annual Forest Inventory and Analysis Symposium. 167-172.

Proctor, P.; Van Deusen, P.C.; Heath, L.S.; Gove, J.H.; 2003. The open-source movement: an introduction for forestry professionals. In: 2003 Proceedings of the Fifth Annual Forest Inventory and Analysis Symposium. 203-208.

Ranneby, B.; Cruse, T.; Hägglund, B.; Jonasson, H.; Swärd, J.. 1987. Designing a new national forest survey for Sweden. Stud. For. Suec. No. 177.

Reams, G.A.; Van Deusen, P.C. 1993. Synchronic large-scale disturbances and red spruce growth decline. Canadian Journal of Forest Research. 23(7):

Reams, G.A.; Van Deusen, P.C. 1998. Chapter: detecting and predicting climatic variation from old-growth baldcypress. In: The Productivity and Sustainability of Southern Forest Ecosystems in a Changing Environment. 128 of the series Ecological Studies 701-716.

Roesch, F.A.; Coulston,J.W.; Van Deusen, P.C.; Podlaski, R. 2015. Evaluation of Image-Assisted Forest Monitoring: A Simulation. Forests 6:2897-2917.

Roesch, Jr., F.A.; Van Deusen, P.C. 1993. Control variate estimators of survivor growth from point samples. Forest Science. 39(1): 66-77.

Roesch, F.A.; Van Deusen, P.C. 2010a. Anomalous diameter distribution shifts estimated from FIA inventories through time. Forestry 83: 269-276.

Roesch, F.A.; Van Deusen, P.C. 2010b. Anomaly detection for analysis of annual inventory data: A quality control approach. Southern Journal of Applied Forestry. 34:131-137.

Roesch, F.A.; Van Deusen, P.C. 2012. Monitoring forest/non-forest land use conversion rates with annual inventory data. Forestry 85: 391-398.

Roesch, F.A.; Van Deusen, P.C. 2013. Time as a dimension of the sample design in national scale forest inventories. Forest Science. 59:610-622.

Roesch, F.A.; Van Deusen, P.C.; Zhu, Z. 1995. A comparison of various estimators for updating forest area coverage using AVHRR and forest inventory data, photogrammetric engineering & remote sensing 61(3): 307-311.

Spinney, M.P.; Van Deusen, P.C. 2007. Visualize and analyze US forest inventory data with GForest. ESA/SER Joint Meeting, San Jose Calif., Aug. 5-10, 2007.

Spinney, M.P.; Van Deusen, P.C.; Heath, L.S.; Smith, J.E. 2005. COLE: Carbon On-line Estimator, Version 2. In: Kenefic, Laura S.; Twery, M. J., eds. Changing Forests - Challenging Times: Proceedings of the New England Society of American Foresters 85th Winter Meeting; 2005 March 16-18; GTR NE-325. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station: 28

Spinney, M.P.; Van Deusen, P.C.; Roesch, F.A. 2006. On-line analysis of southern FIA data. In: Aguirre-Bravo, Celedonio et al. Eds. 2004. In: Monitoring Science and Technology Symposium: Unifying Knowledge for Sustainability in the Western Hemisphere; 2004 September 20-24; Denver, CO. 2004 September 20-24; Denver, CO. Proceedings RMRS-P-42CD. Fort Collins, CO, USDA Forest Service, Rocky Mountain Research Station: 875-878

Van Deusen, P.C. 1984. Complete and partial generation of tree characteristics for mixed species stands. Berkley: University of California. Ph.D. dissertation.

Van Deusen, P.C. 1986. Fitting assumed distributions to horizontal point sample diameters. Forest Science 32: 146-148.

Van Deusen, P.C. 1987a. Combining taper functions and critical height sampling for unbiased stand volume estimation. Canadian Journal of Forest Research. 17(11): 1416-1420.

Van Deusen, P.C. 1987b. Testing for stand dynamics effects on red spruce growth. Canadian Journal of Forest Research. 17:1487-1495.

Van Deusen, P.C. 1987c. 3-p sampling and design versus model-based estimates. Canadian Journal of Forest Research. 17(2): 115-117.

Van Deusen, P.C. 1988. Simultaneous estimation with a squared error loss function. Canadian Journal of Forest Research. 18(8): 1093-1096, 10.1139/x88-167.

Van Deusen, P.C., editor, 1988. Analysis of great Smoky Mountain red spruce data. USFS South. For. Exp. Sta. GTR SO-69. 67p.

Van Deusen, P.C. 1989a. A model based approach to tree ring analysis. Biometrics 45(3): 763-779.

Van Deusen, P.C. 1989b. Multiple-occasion partial replacement sampling for growth components. Forest Science. 35(2):388-400.

Van Deusen, P.C. 1990a. Critical height versus importance sampling for log volume: does critical height prevail? Forest Science. 36:930-938.

Van Deusen, P.C. 1990b. Evaluating time-dependent tree ring and climate relationships. Journal of Environmental Quality 19(3):481-488.

Van Deusen, P.C. 1990c. A dynamic program for cross-dating tree rings. Canadian Journal of Forest Research. 20(2): 200-205.

Van Deusen, P.C. 1993. Sampling moving strata on two occasions. Canadian Journal of Forest Research. 23: 96-100.

Van Deusen, P.C. 1994. Correcting bias in change estimates from thematic maps. Remote Sensing of Environment 50(1):67-73.

Van Deusen, P.C. 1995a. Difference sampling as an alternative to importance sampling. Canadian Journal of Forest Research. 25:487– 490.

Van Deusen, P.C. 1995b. Modified highest confidence first classification. Photogrammetric Engineering and Remote Sensing: 61(4):419-425.

Van Deusen, P.C. 1996a. Incorporating predictions into an annual forest inventory. Canadian Journal of Forest Research: 26, 1709-1713.

Van Deusen, P.C. 1996b. Habitat and harvest scheduling using Bayesian statistical concepts. Canadian Journal of Forest Research. 26(8): 1375-1383.

Van Deusen, P.C. 1996c. Unbiased estimates of class proportions from thematic maps. Photogrammetric Engineering and Remote Sensing: 62(4):409-412.

Van Deusen, P.C. 1997. Annual forest inventory statistical concepts with emphasis on multiple imputation. Canadian Journal of Forest Research: 27:379-384.

Van Deusen, P.C. 1999a. Modeling trends with annual survey data. Canadian Journal of Forest Research 29:824-1828.

Van Deusen, P.C. 1999b. Multiple solution harvest scheduling. Silva Fennica 33(3):207-216.

Van Deusen, P.C. 2000a. Pros and cons of the interpenetrating panel design. In: Proceedings of the First Annual Forest Inventory and Analysis Symposium, San Antonio, Texas, November 2-3, 1999, GTR NC–213. North Central Research Station, USDA Forest Service, St. Paul, MN: 14-19.

Van Deusen, P.C. 2000b. Alternative sampling designs and estimators for annual surveys. In: Hansen, M.; Burk, T. eds. Integrated Tools For Natural Resources Inventories In The 21st Century: proceedings of the IUFRO conference: 1998 August 16-20; Boise, ID., USDA For. Ser. GTR NC-212,. St. Paul, MN, USDA Forest Service, North Central Research Station: 192-196.

Van Deusen, P.C. 2001a. Scheduling spatial arrangement and harvest simultaneously. Silva Fennica 35(1):85-92.

Van Deusen, P.C. 2001b. Alternatives to the moving average. In Reams, G.A.; McRoberts, R.E.; Van Deusen, P.C., eds. 2001. Proceedings of the second annual Forest Inventory and Analysis symposium; 2000 October 17-18; Salt Lake City, UT. GTR SRS–47. Asheville, NC, USDA Forest Service, Southern Research Station: 90-93

Van Deusen, P.C. 2002a. An EM algorithm for capture-recapture estimation. Environmental and Ecological Statistics. 9(2):151-165.

Van Deusen, P.C. 2002b. Comparison of some annual forest inventory estimators. Canadian Journal of Forest Research. 32, 1992-1995.

Van Deusen, P.C. 2004. Forest inventory estimation with mapped plots. Canadian Journal of Forest Research. 34: 493– 497.

Van Deusen, P.C. 2005. An alternative view of some FIA sample design and analysis issues. In McRoberts et al. eds. Proceedings of the fourth annual forest inventory and analysis symposium. November 19–21, 2002. New Orleans, LA. GTR NC-252. St. Paul, MN, USDA Forest Service, North Central Research Station: 187-191

Van Deusen, P.C. 2007a. The poor man's Geographic Information System: plot expansion factors. In: McRoberts, R.E.; Reams, G.A.; Van Deusen, P.C.; McWilliams, W.H., eds. Proceedings of the seventh annual forest inventory and analysis symposium; October 3-6, 2005; Portland, ME. GTR WO-77. Washington, DC: U.S. Department of Agriculture, Forest Service: 227-229.

Van Deusen, P.C. 2007b. Weighted estimators for forest inventory mapped plots. Canadian Journal of Forest Research. 37: 1142–1145.

Van Deusen, P.C. 2010. A method to evaluate the option of storing carbon in your forest. Canadian Journal of Forest Research. 40(11): 2243-2247.

Van Deusen, P.C., Prisley, S.P.; Lucier, A.A. 1999. Adopting an annual inventory system: user perspectives. Journal of Forestry 97: 11-14.

Van Deusen, P.C.; Baldwin Jr., V.C. 1993. Sampling and predicting tree dry weight. Canadian Journal of Forest Research. 23(9): 1826-1829.

Van Deusen, P.C.; Biging, G.S. 1984. Crown volume and dimensional models for mixed conifers of the Sierra Nevada. Research Note No.9. Northern California Forest Yield Cooperative Department of Forestry and Resource Management. University of California, Berkeley, Ca. 94720.

Van Deusen, P.C.; Dell, T.R.; Thomas, C.E. 1986. Volume growth estimation from permanent horizontal points. Forest Science. 32. 415-422.

Van Deusen, P.C.; Gove, J.H. 2011. Sampling coarse woody debris along spoked transects. Forestry 84 (2): 93-98.

Van Deusen, P.C.; Grender, J.M. 1989. An alternative estimator for horizontal point clusters. Forest Science. 35:257-262.

Van Deusen, P.C.; Heath, L.S.. 2010. Weighted analysis methods for mapped plot forest inventory data: Tables, regressions, maps and graphs. Forest Ecology and Management. 260(9):1607–1612.

Van Deusen, P.C.; Irwin L.L. . 2012. Propensity score methods for assessing habitat selection with telemetry data. Forestry 85(4):523-529.

Van Deusen, P.C.; Irwin, L.L.; Fleming, T.L. 1998. Survival estimates for the northern spotted owl. Canadian Journal of Forest Research. 28(11): 1681-1685.

Van Deusen, P.C.; Koretz, J. 1988. Theory and programs for dynamic modeling of tree rings from climate. GTR SO-70. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 18 p.

Van Deusen, P.C.; Lynch, T.B. 1987. Efficient unbiased tree-volume estimation. Forest Science. 33(2):583-590.

Van Deusen, P.C.; Matney, T.G.; Sullivan, A.D. 1982. A Compatible System for predicting the volume and diameter of sweetgum trees to any height. Southern Journal of Applied Forestry. 6(3): 159-163.

Van Deusen, P.C.; Meershaert, W.J. 1986. On critical height sampling. Canadian Journal of Forest Research.16(6):1310-1313.

Van Deusen, P.C.; Reams, G.A. 1993. Frequency domain tree-ring standardization. Forest Science. 39(1):55-65.

Van Deusen, P.C.; Roesch, F.A. 2007. Constrained map-based inventory estimation. Forestry 80:445-453.

Van Deusen, P.C.; Roesch, F.A. 2009a. Estimating forest conversion rates with annual forest inventory data. Canadian Journal of Forest Research. 39, 1993–1996.

Van Deusen, P.C.; Roesch, F.A. 2009b. A volume change index for forest growth and sustainability. Forestry 82: 315-322.

Van Deusen, P.C.; Roesch, F.A. 2011. Sampling a tree for total volume, biomass, and carbon. Journal of Forestry 109(3): 131-135.

Van Deusen, P.C.; Roesch, F.A. 2013. Trends and projections from annual forest inventory plots and coarsened exact matching. Mathematical and Computational Forestry & Natural-Resource Sciences 5(2): 126-134.

Van Deusen, P.C.; Roesch, F.A. 2015. Plot intensity and cycle-length effects on growth and removals estimates from forest inventories. Mathematical and Computational Forestry & Natural-Resource Science 7(1):32-37.

Van Deusen, P.C.; Roesch, F.A.; Wigley, T.B. 2013. Estimating forestland area change from inventory data. Journal of Forestry. 111: 126–131.

Van Deusen, P.C.; Snow, G.A. 1991. Paired-tree study suggests 20-year recurrent slash pine blight. Canadian Journal of Forest Research. 21(7): 1145-1148, 10.1139/x91-160.

Van Deusen, P.C.; Sullivan, A.D.; Matney, T.G. 1981. A prediction system for cubic foot volume of loblolly pine applicable through much of its range. Southern Journal of Applied Forestry. 5(4):186-189.

Visser, H. 1986. Analysis of tree ring data using the Kalman filter technique. IAWA Bulletin n.s., 7(4):289-297.

Wigley, T.B.; Mitchell, M.S.; Van Deusen, P.C.; Lancia, R.A. 2001. Tools for blending economic and ecological objectives on private forestlands. Transactions North American Wildlife and Natural Resources Conference. 66:61–76