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2004 RAY K. LINSLEY AWARD

Charles Thomas Haan, Recipient

This award was established in 1986 to honor the first Vice President of AIH, Ray K. Linsley - one of the great leaders in the hydrological sciences. The award is presented annually, on the recommendation of the AIH Awards Committee, for a major contribution to the field of groundwater hydrology. The first Ray K. Linsley Award was presented to Peter O. Wolf at the AIH International Conference on Advances in Ground-Water Hydrology in Tampa on November 17, 1988.

Citation: Presented by Stephen J. Burgess, Department of Civil and Environmental Engineering, University of Washington

It is my privilege to introduce the recipient of the 2004 Ray K. Linsley Jr. Award, Charles Thomas Haan, Regents Professor and Sarkeys Distinguished Professor Emeritus, Department of Biosystems and Agricultural Engineering, Oklahoma State University.

Dr. Haan earned his BS and MS degrees in Agriculture Engineering from Purdue University in 1963, and 1965, respectively, and his Ph.D. in Agricultural Engineering, from Iowa State University, in 1967.

Tom began his distinguished career as an Assistant professor of Agricultural Engineering at the University of Kentucky, Lexington in 1967. He progressed rapidly through the academic ranks and was promoted to Professor of Agricultural Engineering in 1976. He moved to Oklahoma State University, Stillwater, Oklahoma in 1978 as Professor and Head of the Department of Agricultural Engineering. He was appointed Regents Professor in 1987 and was appointed Regents Professor and Sarkeys Distinguished Professor in 1989. He became Professor Emeritus in January 2001. He is extremely active in retirement most notably as an ordained Permanent Deacon for the Diocese of Tulsa where he serves at the St. John's University Parish and Catholic Student Center in Stillwater.

Tom has been honored for his professional contributions and leadership on numerous occasions. His honors include:

- Young Researcher of the Year Award (1975) American Society of Agricultural Engineers.
- Halliburton Outstanding Faculty Member, College of Engineering, Oklahoma State University, 1987-88.
- Fellow, American Society of Agricultural Engineers, 1988.
- Sarkeys Foundation, Elmo Baumann Award, College of Agriculture, Oklahoma State University, 1989.
- Hancor Soil and Water Award, American Society of Agricultural Engineers, 1990.
- Professional Achievement in Engineering Award, Iowa State Alumni Association, 1991.
- Alpha Epsilon distinguished teaching Award, Agricultural Engineering Dept., Oklahoma State University, 1992-93.
- Outstanding Graduate Teaching Award, Oklahoma State University, 1993-94.
- John Deere Gold Medal, American Society of Agricultural Engineering 1997.
- Eminent Faculty Award, Oklahoma State University, Fall 2000.

He was elected a Member of the National Academy of Engineering in 1995.

He has served the profession generously:

- As President of the American Institute of Hydrology from 1995 to 1998.
- As a committee member on three highly significant National Academy of Science, Water Science and Technology Board committees: the "Committee on Ground Water Recharge in Surface Mined Areas", the "Committee on Water Resources Research of the US Geological Survey", and the "Committee on the American River Flood Frequency".
- As a member of the Great Plains Agricultural Council Task Force on Water Quality.
- On numerous technical and administrative committees within the American Society of Agricultural Engineers, as an elected Director of the Soil and Water Division, a member of the Fellows Screening Committee, and a member of the Board of Directors.

He has contributed significantly as a reviewer of both academic programs in the United States and of government and academic research programs nationally and internationally.

Tom has been the leader in major research efforts across a wide range of societally important hydrologic enquiry. Some of his research interests, in approximate chronological order, include:

- Identification and Removal of Pesticides from Rural Water Supplies
- Stochastic Simulation of Daily Rainfall
- Evaluation of Vegetal Filters for Reducing Sediment Production from Active Strip Mines
- Water Requirements and Economic Feasibility of Supplemental Irrigation in the Midwest
- Evaluation of Detention Basins for Controlling Runoff and Sedimentation from Surface Mines
- Incorporation of Risk in Designing Water Resources Facilities
- Spatial and temporal variability of soil properties and effects on land use
- Hydrologic and Water Quality Modeling of Sediment and Chemical Transport
- Real Time Flood Forecasting
- Hydrologic and Water Quality Modeling with Geographic Information Systems

This is a rich body of work.

Tom has published numerous papers. I have chosen three, one each from the 1970s, 1980s, and 1990s, that illustrate the diversity of his work:

Tollner, E. W., B. J. Barfield, C. T. Haan and T. Y. Kao. Suspended Sediment Filtration Capacity of Simulated Vegetation. Transactions, American Society of Agricultural Engineers, 19(4):678-682, 1976.

Haan, C.T. Parametric Uncertainty in Hydrologic Modeling. Transactions, American Society of Agricultural Engineers 32(1):137-146, 1989.

Haan, C. T., B. Allred, D. E. Storm, G. Sabaagh and S. Prabhuu. A Statistical Procedure for Evaluating Hydrologic/Water Quality Models. Transactions, American Society of Agricultural Engineers 38(3):725-733, 1995.

His books have been most influential. They include:

Haan, C. T. Statistical Methods in Hydrology. Iowa State University Press, 1977, (second edition, 2002).

Haan, C. T. and B. J. Barfield. Hydrology and Sedimentology of Surface Mined Lands. University of Kentucky, College of Engineering, 1978.

Barfield, B. J., R. Warner and C. T. Haan. Applied Hydrology and Sedimentology for Disturbed Areas. Oklahoma Technical Press, Stillwater, Oklahoma, 1981.

Haan, C. T., H. P. Johnson and D. L. Brakensiek (ed.). Hydrologic Modeling of Small Watersheds. American Society of Agricultural Engineers Monograph, 1982.

Haan, C. T., B. J. Barfield and J. C. Hayes. Design Hydrology and Sedimentology for Small Catchments. Academic Press. 1994.

Tom has been a splendid educator at all levels. He supervised the Graduate thesis work of eleven MS and fifteen Ph.D. degree colleagues. The mark of a great scholar, educator, and research leader is the pride he or she takes in the accomplishments of his or her students and colleagues. Tom is graciousness personified. He included *"some personal notes"* at the end of his curriculum vitae. One that captures well the generosity and humanity of our Linsley Awardee, is: "Perhaps the awards I am most pleased with are not ones I have received but represent recognition received by my students".

Ray Linsley left a considerable legacy from his books, papers, teaching, and graduate student and colleague mentorship, and had a deep commitment to improving practice in the profession. Tom has likewise dedicated his professional life to those activities. As one who benefited considerably from Ray's mentorship, I am delighted that the names Tom Haan and Ray Linsley are now linked through this prestigious award from the American Institute of Hydrology.

2004 Ray K. Linsley Award Recipient: C. T. Haan

I begin by thanking Steve Burges for his generous and kind citation and introduction. It certainly is a great honor to have my name listed beside the other recipients of this prestigious award, names that include that of Steve Burges.

I must thank my wife Jan for supporting me throughout my career. We were married more than 37 years ago the weekend after I finished my Ph D at Iowa State. Over the years she has attended many professional meetings including AIH meetings with me and listened to many talks I have given. Now that I am retired you may think that burden has been lifted but it has merely been replaced with having to listen to sermons I give from time to time at Mass on Sundays.

Thanks to AIH for promoting professionalism in hydrology, for developing a means of guaranteeing professionalism in hydrology, and for recognizing outstanding hydrologist like Ray Linsley by naming major awards after them.

Thanks to officers of AIH and volunteers of AIH who are the backbone of AIH and make it possible for the organization to function. Having served in that capacity I know how many hours they devote to AIH activities. If any of you are members of AIH and are not volunteering, please do so. If you are not a member, join up.

I was going to say some words about Helen Klose who was so helpful and essential during my time as President of AIH; however, since she is going to be recognized formally in just a few minutes, I will pass on that opportunity.

Thanks to my students and colleagues at Purdue, Iowa State, the University of Kentucky, and Oklahoma State University. When awards are given, generally one person is recognized but behind that person are many others who made the contributions of the one recognized possible. That is certainly the situation in my case.

In preparing for this short presentation I went back and looked at my PhD dissertation, typed by my wife Jan, completed in the Spring of 1967, and titled "Hydraulics of Watersheds Characterized by Depressional Storage". The very first reference in the text of that dissertation was to Linsley and Franzini's (1955) text on Elements of Hydraulic Engineering. In all I had 14 citations to the work of Prof Linsley. Ten of the 24 pages of my literature review referred to the Stanford Project in Hydrologic Simulation.

I think it is safe to say that even though I have had only a passing acquaintance with Prof Linsley, he had great influence on my career.

Steve has indicated that I retired in Jan of 2001. When I retired, I retired. I boxed up all of my books and papers, loaded them in the pack of my pickup, completely filling it, and took them to our daughter who is on the faculty at Texas A&M working in an area very close to the area I worked in.

Not only that but I dropped all of my professional memberships and affiliations. I did all of these things, not out of any animosity toward the profession, my employer or anything like that. I did it because I had finished my career as a hydrologist and it was time to move on. I no longer wanted my identity to be tied to my past, to who I was as a hydrologist, any credentials I had, any awards I had received, any work I had done.

In April of 1997 I was ordained to the clerical state as a permanent deacon in the Catholic Church. Especially since my retirement I devote a great deal of time working with others, especially those in some kind of need. This is a much greater challenge than going to the office each day and playing around on the computer and calling it hydrology.

Now when people ask me what I do, and it seems to be important to many people what others do, I tell them I am a deacon and I am a recovering hydrologist.

As a hydrologist we go through life being forced to make certain assumptions so that the problems we are working on are tractable. This is especially true of modelers and hydrologists who have to come up with quantitative estimates to be used in the design of something or other. The design engineer wants numbers. Design engineers and hydrologists work closely together. Often they are the same person. Many of you are probably not only hydrologists but engineers as well.

To come up with those numbers, models have to be used. Maybe a very complex model, maybe a very simple model. But all models, simple or complex, require assumptions.

We make assumptions about the uniformity and distribution of soils temporally, and spatially and with respect to depth. We make assumptions about land use, cover, infiltration characteristics, and slopes. We make assumptions about drainage characteristics, channels, channel roughness, and so forth. We make assumptions about the spatial and temporal distributions of rainfall. We make assumptions about the temporal changes that might occur in a drainage area. We make assumptions about stationarity of hydrologic data series. We make assumptions that we don't even realize we are making.

I am not saying this is bad. It is simply a fact. We must come up with numbers. The way we do this, whether we realize it or not, is to put some algorithms together in our models, give them some physically sounding name like infiltration, overland flow, subsurface runoff, and so forth. Then we attach some coefficients to these algorithms so we can make the model predict numbers similar to what we have observe if we are lucky enough to have any observed numbers or somewhat close to what we expect based on our experience and numbers from similar areas.

I have done this many times. I am sure many of you have as well. As a matter of fact, I have been doing it for over 30 years.

Then one day as I am looking out my office window watching it rain, something I dearly love to do, and watching the runoff from the parking lot I realize that I have never really seen this thing we call uniform overland flow, or steady overland flow, or steady, uniform overland flow of the type described in texts and model user manuals if one even exists.

I am driving home from work, a distance of only 3 miles, leaving my office in a heavy rainfall and arriving home on dry pavement and suddenly I am flooded with the realization that rainfall is not uniform spatially and temporally. I am over dramatizing but it is why a fundamentalist may fear discovering there is an error in the Bible! If there is one error, what about the inerrancy in the rest of the Bible. If this modeling assumption is not met, what about the rest of the assumptions in the model I am using?

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So many of the assumptions we make in hydrology are made in order to get a solution not because they have any relationship with reality.

I once sat on a panel of "experts" charged with coming up with an estimate of the 200 hundred-year flood on a major river through an important metropolitan are. One hundred years of data were on hand. You would think this was a relatively straight forward problem. Yet we spent endless hours discussing what probability density function to use and how to estimate the parameters of the probability density function and whether to use all of the data or to truncate the low flows and how to handle land use changes over the years ad infinitum. There was a lot at stake economically in terms of where the flood plain would be set and in terms of professional reputations. Most of the discussions had little to do with hydrology and a lot to do with math, statistics and associated assumptions.

As a student at Purdue I had the good fortune of working for Parr and Bertrand as they made infiltration measurements with the Purdue sprinkling Infiltrometer they had developed. The plots were about 4 foot square. It was startling how much variation there would be in the infiltration rates measured on plots only a few feet apart having no visible differences.

Around this same time I also worked with Don Meyer as he collected erosion data on somewhat larger plots subjected to artificial rainfall using his Rainulator. The data have been widely used in the Universal Soil Loss Equation that some of you may be familiar with. Again, there was large variation from plot to plot on apparently similar plots.

I mention all of these things because I am concerned that we now are turning out students who are excellent with computers, very good modelers, very good in math and statistics but who have been denied much in the way of natural hydrologic processes and natural hydrologic observation. When hydrologic questions arise, they are often answered in terms of a model and how the model would respond to the situation under question rather than relying on much in the way of underlying knowledge of flow processes in natural systems. What concerns me even more is we often do not appear to recognize the difference. We learn to think like a model, not like a hydrologist.

You have noted I have not mentioned water quality or environmental models. To me these models are at least an order of magnitude more difficult than water quantity models. Water quality depends on the actual flow paths and soils and other geologic formations the water actually contacts, how long this contact is, and what reactions take place. Obviously if the water quantity part of the model does not adequately define these flow paths and does not properly handle these interactions, how can the water quality component be expected to represent reality. Thank goodness for coefficients, huh?

I bring up these challenges to support a contention that models have not replaced our need for data, have not replaced our need for sound observations of hydrologic processes, have not replaced our need for devoting time in the classroom and especially in the field to understanding hydrology apart from algorithms, math and statistics.

I think Prof Linsley would agree with me on this. I seem to recall in one of the Stanford reports words to the effect that the Stanford Watershed Model was designed so that as knowledge about a component was improved, that component could be replaced with an improved one. It seems to me that improvements in our ability to manipulate larger and more complex pieces of data and information have outstripped any advancement we have made in basic understanding of natural hydrologic processes themselves.

When one is recovering from an addiction they should stay away from what they are addicted to. As a recovering hydrologist I was getting along pretty well until Steve called me a few weeks ago with information on this honor. I am very appreciative of the honor you have given me. It truly is a great honor. I wish all of you well as you continue to improve our knowledge of hydrology and application of that knowledge to improving the world we live in. Now I must go home and start my recovery all over again.

~ C. T. Haan, Recipient