

Water research and management in semiarid environments: Closing symposium address

Kenneth G. Renard

To those of you who have taken the time to prepare papers for this special symposium, I must add thanks, you did an outstanding job. The resulting collection of papers appearing in this special issue of the *Journal of Soil and Water Conservation* is an exceptional and lasting tribute. I do have the following specific comments about the symposium:

1. Instrumentation has always held a special spot with me. I recall discussions with Fred Blaisdell and Bill Ree (way back when) who, in essence, stated that “the most valuable thing that we leave our successors is good data and not the computer models that we have all become so overwhelmed with.” If we leave the best possible data, our successors will postulate hypotheses that we have not yet thought of, and which the data we leave will assist in the validation of. Young hydrologists need to work in the field observing flow phenomenon as a supplement to their analytical work.

2. Partnering between Natural Resources Conservation Service (NRCS) [formerly called the Soil Conservation Service (SCS)] and the Agricultural Research Service (ARS) continues to be a priority topic as well it should be. I am pleased to see all the NRCS participants at this Symposium. During the 1970s, we hosted a number of workshops between SCS and ARS hydrologists in Tucson and elsewhere. Bob Rallison (and later Norm Miller), SCS Chief Hydrologists, worked closely with me and others to arrange technology transfer meetings (we didn’t call them technology transfer or the new vernacular, partnering). These workshops have been most helpful in our ARS support and response to NRCS research needs in hydrology.

Similar associations have developed over the years through the efforts of Dr.

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Tom Hakonson and his associates at the Los Alamos National Lab of DOE (Department of Energy). There are many citations in the Center’s bibliography with employees from Los Alamos.

3. The runoff sessions in the program were most interesting. It’s encouraging to see that Pete Hawkins is still not forgetting about curve numbers. Unfortunately, the time allocated for most of the papers was not sufficient to precipitate (no pun intended) the discussions needed. Many of the topics mentioned are not that different from the issues that were surfaced at some of the workshops when I first started with ARS. New techniques such as remote sensing, laser profiling, geographic information systems (GIS), digital elevation models (DEM), decision support systems (DSS), are all tools that facilitate natural resource model data assembly. But I often ask myself, “If I needed to evaluate runoff from alternative management systems for natural resource protection and use, how would I go about it?” The answer is rather obvious. “Use some form of CNs or one of the popular and available models using such.”

4. The papers presented in the precipitation and runoff session are also noteworthy. As I reflect back on Walt Wischmeier’s work, I am amazed to see how successful he was in producing technology that has survived the test of time. Criticism of the USLE has generally involved questions about “Why didn’t Walt use a direct runoff prediction in his soil erosion estimates?” Again, the answer is rather obvious. “He tried but was not successful in reflecting management practices in the runoff prediction!” The problems of runoff estimates are still present despite time-based infiltration routines such as Green-Ampt. Spatial runoff variability remains one of the most perplexing problems in Natural Resource Modeling. “How are we going to overcome these problems?” I can only say that I wish I could envision a solution. Problems of surface sealing, crusting, soil and management differences on a slope, etc., are not

easily addressed. Our incomplete knowledge of the cause/effect sequences lead to another conclusion. “We need to use more probability relations in natural resource modeling to mask our incomplete knowledge of the processes we describe with deterministic relationships.”

5. The collection of papers involving RUSLE were excellent. But again, although the recommendations that RUSLE be considered an interim solution for the larger issues of water quality evaluation and control is still a major limitation. The more process based WEPP approach is conceptually correct, but since the 1985 Soil Erosion Workshop convened in Lafayette, Indiana, the state-of-the-art has not progressed as envisioned. The major advantage of WEPP over the RUSLE approach is in its application to larger areas where concentrated flow transport and deposition persist.

6. The future for soil erosion/sediment yield estimates on a watershed scale will obviously dictate research activities for some time to come. But more importantly, there will undoubtedly be a suite of models for erosion and sediment transport prediction based on the specifics of what type answers are needed. If one is to design a permanent reservoir sediment storage pool for a large heterogeneous watershed, then RUSLE is probably not appropriate technology. Other models can do better. But I also remember years ago a conversation between Tom Maddock II and Emmett Laursen where the conclusion was that the state-of-the-art in sedimentation was not how many significant figures to carry a simulation to, but rather on what log cycle to expect the answer to be. Have times changed from this discussion of a few years back? I suspect not appreciably!

7. The panel discussions were excellent and prompted much audience discussion. Despite the rather generous times allotted, the discussions could have gone longer. A very important theme that stood out in all three panel discussions was the future of hydrologic research. Data collection is basic—but who is going to do it since universities are training computer modelers and ARS hires university trained hydrologists. Data collection and analyses are detached both in process and people and there will be a generational loss in our data collection abilities because of complexities in university research and training and national research needs. There is a need to rethink data from a deterministic point scale and extrapolate so that we work from large scale down to small scale. The watershed approach, which takes into

account spatial scales, to research in semiarid environment management was apparent in all panel discussions. A large watershed model cannot be built by the simple addition of small watersheds and large watershed data are essential for model validation.

People who made impressions on me that affected my career

My career with ARS began in February 1957 when I began working with Neal E. Minshall, a Research Hydraulic Engineer in Madison, Wisconsin, in the Watershed Technology Branch. My decision to start with ARS was made because I could work an adjusted tour of duty and take classwork toward an MS degree. I spent much of the ensuing two plus years summarizing the data which was in the Madison files for the "Black Book" watershed data summaries. In that assignment, I learned the importance of data accuracy and completeness. Neal would spend weeks checking and rechecking data summaries (most calculations were done by hand as digital computers were just starting to become available). On my MS thesis exam, I remember vividly the probing questions of the faculty members like Drs. Arno T. Lenz (my advisor and chair of Civil Engineering), James Villemonte, and Gerald Rohlich. They impressed me because they probed and asked questions until I finally realized that I really was pretty stupid if I thought I knew anything about hydrology.

In the early summer of 1959, I received a call from Mr. Louis Glymph, head of the Watershed Technology Branch of ARS, asking when I would be available to transfer to the Walnut Gulch Experimental Watershed in Tombstone, Arizona. WOW, what a shock when on my house hunting trip to Tombstone, I discovered how green the desert was (the trip was in August during the summer monsoon season). Louie Glymph also told me not to worry about buying a house in Tombstone because I was to be there only a short time learning about hydrologic field instrumentation and data collection. Tombstone was a real eye opener. In Tombstone, I replaced Dave Woolhiser who was transferring to Madison to begin work on his PhD under Dr. Lenz. As the resident engineer, I became very involved in the instrumentation of Walnut Gulch. On my travel to Tombstone, I went via Stillwater, Oklahoma, and the ARS Outdoor Hydraulic Laboratory. I met Bill Ree and Wendell Gwinn on that trip and worked closely with them on construction and hydraulic rat-

ings of what became known as the Walnut Gulch Supercritical Flumes.

Bob Keppel was my first supervisor in the Walnut Gulch work. I soon became indoctrinated with semiarid hydrology and the differences of air mass thunderstorm runoff in ephemeral streambeds. Some of my earliest work on quantifying transmission losses with Bob Keppel subsequently became the basis of Chapter 19 in the SCS National Engineering Handbook which Leonard J. Lane developed. In Tombstone, I also learned that there was more to hydrology than just the engineering approach. I worked with Dr. J. Linton Gardner, Ecologist, and Mr. Joel Fletcher, Soil Scientist. During my time in Tombstone, I expanded the raingage network and completed construction of eight of the large Walnut Gulch supercritical flumes. In 1961, we received some new funding in connection with Senate Document 59, which permitted additional staffing. Early staff additions included Dr. Henry A. Schreiber, Dr. Philip Seff, and David R. Kincaid. Herbert B. Osborn also transferred back to Tucson in 1961 (from Holly Springs, Mississippi) and I began to work closely with him on many investigations over a nearly 30-year period.

In January 1964 I was transferred to Tucson to begin some analytical work and continue the Walnut Gulch instrumentation efforts. I had been fortunate to hire some extraordinarily capable people while I was in Tombstone—a few of whom include Charlie Parrott, Howard Larsen, Charles Escapule, Jim Smith, Bob McGuire, and Art Dolphin. These individuals have carried out the instrumentation and data collection programs that have provided a strong background for the Southwest Watershed Research Center programs. I also started Graduate School at the University of Arizona in Civil Engineering in 1965. There I learned from people like Drs. Emmett M. Laursen, Simon Ince, and Chester C. Kisel, to name a few.

Studying under Dr. Emmett M. Laursen introduced me to sedimentation. Dr. Laursen, the originator of the Laursen Sediment Transport Equation, taught me much about erosion and sediment transport, which led to the obvious dissertation topic involving the application of that technology to Walnut Gulch.

I also spent some time in Beltsville, Maryland. During my first Beltsville assignment (1963), I worked closely with Mr. T.W. Edminster. My assignment was to fill the duties normally assigned to L.L. Kelley. The four weeks I was there went

very quickly. In 1979 I spent over four months in Beltsville, again on the National Program Staff (NPS). Only health problems precluded that being a permanent assignment. That experience was quite different from the earlier assignment. I was working in A.R. (Robbie) Robinson's position and met David A. Farrell who I have enjoyed working with over many years. Congressional inquiries took much time. I learned that an NPS person needed to be a jack of all trades. I remember spending days working with the Department of Agriculture people on how they could sample from the bottom of stored sugar piles (purchased in price-support programs) and stored in ~20 meter high piles in a warehouse. The concern was what was happening to the sugar quality with time.

When I became acting research leader at the Southwest Watershed Research Center in the late 1960s, I was sent to the first of numerous annual planning conferences for the ARS Soil and Water Conservation Division. At these conferences I became familiar with people like Cecil Wadleigh, Jessie Lunin, Bill Raney, Carl Carlson, Robert B. Hickok, Albert R. Grable, and last but not least, Dr. Donald L. Brakensiek. In fact, I roomed with Don at several of these conferences and we became close friends as a result of these meetings.

Visiting scientists

Now back to the Southwest Watershed Research Center. In 1971, Dr. Donald L. Chery convinced me that we should support Dr. Mordecai H. Diskin who wanted to join us for a sabbatical leave. That visit was the first time we hosted a visitor outside of ARS. Dr. Diskin was followed a few years later by Drs. Ernest Rawitz, Peter Todorovic, Richard H. Hawkins, Walter C. Boughton, Joseph Morin, Conrad G. Keyes, Jr., Terry J. Toy, Waite R. Osterkamp, Thomas Hakonson, Mark A. Nearing, Lloyd W. Gay, and Donald F. Post. Each of these individuals made significant contributions to our research. In the early 1980s, George R. Foster spent time with us and that association subsequently proved to be most useful to the erosion research efforts we completed together. Donald L. McCool spent a year with us in 1990 and helped Roger Simanton and me with RUSLE development. Drs. Athol Abrahams and Tony Parsons worked with us on erosion processes in arid areas in the late 1980s at Walnut Gulch. These associations plus close cooperation with NRCS and Mexican colleagues have been essential to our efforts

to develop technology applicable to a wide variety of scenarios.

Graduate students

We have been very fortunate while I was in Tucson to work with many outstanding graduate students from the University of Arizona and elsewhere. Although the list is much too extensive to enumerate, they have contributed notably to our research and have been an inspiration to the entire staff.

Coworkers

I have already mentioned some of the outstanding scientists and technicians that I have had the privilege of working with. Drs. Donald L. Chery, Jr., J. Linton Gardner, Henry A. Schreiber, Robert M. Dixon, Robert V. Keppel, Joel E. Fletcher, David R. Kincaid, Fred Libby, Joseph B. Murphey, John M. Tromble, Loel R. Cooper, Herbert B. Osborn, Delmer A. Wallace, G. Paul Lawless, J. Roger Simanton, William E. Emmerich, Mark A. Weltz, David C. Goodrich, David A. Woolhiser, Diana S. Yakowitz, Jeffrey J. Stone, Gary W. Frasier, Leslie A. Bach, Edward E. Shirley, Timothy J. Keefer, Mary H. Nichols, Howard L. Morton, Thomas M. Johnsen, Jr., Jerry C. Cox, and Stuart S. Hardegree all were close allies. Robert E. Wilson, Thomas M. Johnson (Alamogordo Creek in New Mexico), Charles E. Fancher, and Howard D. Larsen made our data collection programs go.

Special thanks to Dr. Leonard J. Lane, the current Research Leader of our Tucson Center. I remember clearly the young fellow who began working with us while he was still a student in a Math-Physics honors program at the University of Arizona. At that time, he was a skinny "kid" who showed a great deal of promise. Leonard, you have come a long way and have developed into an outstanding researcher. To all these coworkers (and I have been a coauthor with most), I can only say thanks!

The many secretaries who have helped me throughout the years also deserve special commendations starting with such early ones as Theo Koenig and Edith Ashmore and ending with John Rocha, Laura Yohnka, and E. Sue Anderson. Without their dedication and support, my career might have been very different. The people who over the years have assisted with data processing are again too numerous to list but need special thanks. Our administrative support has also been outstanding starting with that from Laverne Grayson Tromble, Ruth Campbell, and Clarine (Tinka) Buck.

Bosses

I have had many bosses who have been both inspirational and served as my mentors: Neal Minshall, Bob Keppel, Bob Hickok, Bill Donnan, Lloyd Meyers, Ed Kendrick, Dean Plowman, Jan van Schilf-gaarde, and Leonard Lane. Each of these people have been most supportive and have encouraged my career. Again, thanks! I almost forgot my finest cohort and spouse of 38+ years, my wife, Virginia.

Professional activities

I have had a most rewarding career with many professional societies and have had the privilege of working with many individuals. From my early days as an officer of the American Society of Agricultural Engineers, Arizona Section, as well as serving on many National Technical Committees, I have felt honored. I also have worked many years for the Soil and Water Conservation Society, both as the Chair of the Arizona Section and on national committees including most recently, assignments associated with RUSLE. The help I have had from Timothy J. Kautza, Director of Education and Professional Development for SWCS was truly great.

Perhaps my most intensive society activities have been with the American Society of Civil Engineers. I have held offices in the Southern Arizona Branch, the Arizona Section, and the Irrigation and Drainage Division. I also accepted the challenge from Dr. Ernest Smerdon in 1979 to be the Editor of the *Journal of the Irrigation and Drainage Division*, a challenge that involved contacts with many. For the past three years, I have been a member of the ASCE's Management Group D (activities involving water). All of these voluntary assignments have been fun but have required much night and weekend work. The associates I have worked with have resulted in many lasting friendships.

I should also mention the work with the Food and Agriculture Organization (FAO) of the United Nations. Those contacts took me to Morocco where I had the privilege of working with Dr. Eduardo Seminario and scientists in Fez, El Hociema, Marrakech, Rabat, and Agadir. I also was fortunate to participate in an Expert Consultation on Water Harvesting for Improved Agricultural Production in Cairo, Egypt in 1993.

Finally, I feel strongly that the Watershed Hydrology and Erosion/Sedimentation programs of ARS are in strong and

capable hands. I look forward to reading of the modeling advances and analysis work. I hope to be a part of these advances in my role as a collaborator at the SOUTH(BEST) Watershed Research Center.