Fifty Years of Wind Erosion Research by the USDA Agricultural Research Service at Kansas StateUniversity.

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From 1850 to 1900, the population of the Great Plains of the United States increased 11 times, from about 700,000 to 8,000,000. Many of these settlers were farmers, who plowed the native grass sod and planted crops using tillage methods developed for more humid regions. The introduction of tractors allowed larger acreages to be farmed. These three events, coupled with the properties of the Great Plains soils, mostly aeolian derived, and the semi-arid climate of the region, set the stage for wind erosion during periods of drought. Newspapers reported drought and dust storms from 1886 to 1895 and again from 1914 to 1917.

As the United States entered the 1930's, two major events were beginning. First, the collapse of the country's economy, known as the Great Depression, and an extended drought that caused the "Dust Bowl". Dust storms, known as "Black Blizzards", rolled across the region and deposited dust on ships at sea off the East Coast of the United States. The maximum number of dust storms occurred from 1935 to 1938.

The start of World War II interrupted most soil conservation research during the first half of the 1940's. The publication of Bagnold's book, "The Physics of Blown Sands and Desert Dunes" in 1941 became a point of departure for most basic research on wind erosion in the United States and Canada.

Agricultural research was boosted in the United States by the passage of the Flannagon-Hope bill, officially known as The Research and Marketing Act of 1946. This was the source of funds to establish the Wind Erosion Project in Manhattan, Kansas in late 1947. The project was under the administrative supervision of the Research Division of the Soil Conservation Service (SCS), now the Natural Resource Conservation Service (NRCS), until 1953, when all soil conservation research, except that related to the National Cooperative Soil Survey, was transferred to the Agricultural Research Service (ARS).

The High Plains Wind Erosion Laboratory was established at Kansas State University in the Farm Machinery Hall, a building that was built in 1863 to house the armory of the Reserve Officers Training Core (ROTC) and later the Department of Home Economics. The Laboratory always has been associated with the Department of Agronomy at Kansas State University.

Over the years, 19 scientists have been associated with the Laboratory. Numbers have varied from 1 in 1947 to a high of 10 in 1967. The number has gradually declined to 4 in 1997. The first supervisor was Austin W. Zingg, an Agricultural Engineer, and a pioneer in water erosion mechanics. He assumed his duties in October 1947 and served until 1953. He oversaw the development of the laboratory wind tunnel and related equipment. He also began staffing the project.

Zingg hired Dr. William S. Chepil, a soil scientist, in March of 1948. Dr. Chepil was conducting wind erosion research in Saskatchewan, Canada. He became project leader in 1953 and served in that capacity until his death from cancer in September 1963. A new laboratory facility, which Dr. Chepil planned, was completed just prior to his death.

Zingg also hired Neil P. Woodruff, an Agricultural Engineer, in 1949. Mr. Woodruff became the project's third supervisor in 1963 and served until his retirement in September 1975.

Research conducted during the first 28 years began with developing equipment, such as the laboratory wind tunnel and a portable field wind tunnel, and related instrumentation and methods for studying wind erosion. Studies were conducted on the processes by which soil particles are moved and transported by wind; physical and chemical soil properties that affect soil erodibility; effects of plant cover and residues, surface barrier, topography, surface roughness, and land use on soil drifting; and how major soil factors such as texture, organic matter, calcium carbonate content, water stable aggregates, dry aggregate size distribution, aggregate density, dry aggregate stability, and soil water affect soil erosion by wind.

Other general topics related to wind erosion and its control were wind climatology, wind barrier influence, aerodynamic forces, surface roughness effects, residue conservation tillage, vegetative and nonvegetative soil stabilizers, plant abrasion and tolerance, air quality, surface soil aggregation, soil renewal and erosion tolerance, and deep plowing. The laboratory wind tunnel facilities were expanded throughout the years to its present size.

This early research laid the groundwork for the development of the Wind Erosion Equation (WEQ). The framework of the equation was established before Chepil's death, but the equation was published officially in 1965 by Woodruff and Siddoway.

Upon Woodruff's retirement in 1975, Dr. Leon Lyles, an Agricultural Engineer, became the leader of the unit. He served in that capacity until his retirement in January 1988.

During his tenure, research conducted by the unit's scientists continued to refine some of the earlier work and added some new areas. These included use of drip irrigation to aid in the establishment of shelter belts in semiarid climates; air flow over established multirow and single-row windbreaks and barriers; effect of sandblast damage to crop plants in regard to physiological processes within plants; small grain equivalent (SGE) of growing plants; effect of soil moisture, packing, tillage tool shape, tillage speed, and tillage depth on the number and strength of soil aggregates formed.

Dr. Larry Hagen, an Agricultural Engineer, assumed leadership upon Dr. Lyles' retirement. During his tenure, most of the research of the unit was directed to developing the Wind Erosion Prediction System (WEPS). Dr. Hagen turned over the reins of the unit to Dr. Edward Skidmore, a Soil Scientist, in December 1994, to focus his efforts on completing WEPS.

I want to give a big thank you to Kansas State University, the College of Agriculture, and especially the Department of Agronomy for 50 years of support and for the new offices and laboratories in Throckmorton Hall. The unit moved into these facilities in the summer of 1994.

In closing, I would say that we have come a long way in the last 50 years in developing our knowledge of wind erosion processes, measurement, control methods, and prediction. However, until we can control the climate, we have a ways to go!

References

Woodruff, N. P. and F. H. Siddoway. 1965. A Wind Erosion Equation. SSSA Proc. 29:602-608.

Kansas State University has been providing quality education to the residents of Kansas, the country and the world for the last 150 years. Located in a community with nearly 60,000 people and more than 24,000 students, we are able to provide a safe and supportive environment for our students. Kansas State University has 3 campus locations, two of which, Manhattan and Salina, have complete academic programs and on-campus housing. Olathe is the third and newest extension of the university, focusing on collaborating with industry and Kansas City K-12 schools. Accreditation: Kansas State Universit... WEPS incorporates nearly 70 years of wind erosion research by the U.S. Department of Agriculture (USDA) to provide accurate and universal simulations of soil loss by wind and represents superior wind erosion prediction technology over previous prediction methods. In addition to providing improved estimates of soil loss, WEPS partitions loss, transport, and deposition into coarse (creep + saltation) and fine (suspension) size classes to account for the unique characteristics of each size to enable evaluations of their respective effects on the soil and surrounding environment. It also provides Researchers may also want to simulate wind erosion for a longer period than the length of the measured data record, e.g., for 60 years, which is a typical WEPS simulation run. In addition, the measured data require much more computer disk space than wind summary statistics combined with a stoâ€ chastic wind generator. Therefore, a stochastic wind generaâ€ tor is often more appropriate for use with WEPS than using the measured data directly (Skidmore and Tatarko, 1990; van Donk et al., 2005).Â At Pendleton, the prevailing wind erosion direction is west all year round.Â USDA Wind Erosion Predictions System: Erosion submodel. In Proc. WEPP/WEPS Symposium.