

#1133

July 1995

USDA Forest Service
General Technical Report RM-GTR-264

Biodiversity and Management of the Madrean Archipelago: The Sky Islands of Southwestern United States and Northwestern Mexico

**September 19-23, 1994
Tucson, Arizona**

Technical Coordinators:

Leonard F. DeBano
Gerald J. Gottfried
Robert H. Hamre
Carleton B. Edminster
Rocky Mountain Forest and Range
Experiment Station

Peter F. Ffolliott
University of Arizona

Alfredo Ortega-Rubio
Centro de Investigaciones Biologicas
del Noroeste

Page Design:

Carol LoSapio
Rocky Mountain Forest and Range
Experiment Station

Sponsors:

Rocky Mountain Forest and Range
Experiment Station
U.S. Department of Agriculture
Fort Collins, Colorado

School of Renewable Natural Resources
University of Arizona
Tucson, Arizona

The Research Program of the Southwest Watershed Research Center

Kenneth G. Renard and Leonard J. Lane¹

Abstract.—The Southwest Watershed Research Center of the USDA Agricultural Research Service operates the Walnut Gulch Experimental Watershed located at Tombstone in southeastern Arizona. The semiarid lands which the watershed represents are characterized by extreme variability of precipitation, soils, vegetation, infiltration, runoff, and erosion and sediment yield. The results obtained from the research program of the Southwest Watershed Research Center describe and summarize this temporal and spatial variability and the impact of management decisions in altering the hydrologic and sedimentation cycles. Examples of publications pertaining to erosion control and water quality impacts that have been prepared by the staff of scientists and engineers are presented.

INTRODUCTION

The Southwest Watershed Research Center of the USDA Agricultural Research Service consists of a multidisciplinary staff of 10 scientists and engineers located in Tucson, Arizona. This staff operates the Walnut Gulch Experimental Watershed located at Tombstone in southeastern Arizona. The semiarid lands which the watershed represents are characterized by extreme variability of precipitation, soils, vegetation, infiltration, runoff, and erosion and sediment yield.

lected on the Walnut Gulch Experimental Watershed, are described and used to illustrate the impact of land management practices on the hydrologic cycle in a semiarid environment. Data and research findings from Walnut Gulch are being used to develop new technology for natural resource modeling and management.

Examples of publications pertaining to erosion control and water quality impacts that have been prepared by the staff of scientists and engineers at the Southwest Watershed Research Center are listed below to illustrate the nature of their work.

THE RESEARCH PROGRAM

The results obtained from the research program of the Southwest Watershed Research Center describe and summarize this temporal and spatial variability and the impact of management decisions in altering the hydrologic and sedimentation cycles. Potential impacts of global change on the natural resources of such semiarid lands are also reported. Specific results include frequency relationships for runoff amounts. Analytic simulation models such as CREAMS, RUSLE, WEPP, and KINEROS, developed using data col-

1994

Kustas, W. P., and D. C. Goodrich. 1994. Preface to a collection of papers entitled "Monsoon '90 Multidisciplinary Experiment." *Water Resources Research* 30:1211-1225.

1993

Renard, K. G., L. J. Lane, J. R. Simanton, W. E. Emerich, J. J. Stone, M. A. Weltz, D. C. Goodrich, and D. S. Yakowitz. 1993. Agricultural Impacts in an Arid Environment: Walnut Gulch Studies. *Hydrological Science and Technology* 91:145-190.

Tiscareno-Lopez, M. H., V. L. Lopes, J. J. Stone, and L. J. Lane. 1993. Sensitivity Analysis of the WEPP Watershed Model for Rangeland Applications I:

¹Lead Scientist and Hydraulic Engineer, and Research Leader, USDA Agricultural Research Service, Southwest Watershed Research Center, Tucson, Arizona 85719.

Hillslope Processes. Transactions of the Society of Agricultural Engineers 36:1659-1672.

Woolhiser, D. A., T. O. Keefer, and K. T. Redmond. 1993. Southern Oscillation Effects of Daily Precipitation in the Southwestern United States. Water Resources Research 29:1287-1295.

1992

Lane, L. J., K. G. Renard, G. R. Foster, and J. M. Laflen. 1992. Development and Application of Modern Soil Erosion Technology - The USDA Experience. Australian Journal of Soil Research 30:893-912.

Stone, J. J., L. J. Lane, and E. D. Shirley. 1992. Infiltration and Runoff Simulation on a Plane. Transaction of the American Society of Agricultural Engineers 35:161-170.

1991

Johnsen, T. N., Jr., and H. L. Morton. 1991. Long-term Tebuthiuron Content of Grasses and Shrubs on Semiarid Rangelands. Journal of Range Management 44:249-253.

Hardegree, S. P., and W. E. Emmerich. 1991. Variability in Germination Rate Among Seed (Lots) of Lehman Lovegrass. Journal of Range Management 44:323-326.

Laflen, J. M., L. J. Lane, and G. R. Foster. 1991. WEPP: A New Generation of Erosion Prediction Technology. Journal of Soil and Water Conservation 46:34-38.

Morton, H. L., and A. Melgoza. 1991. Vegetation Changes Following Brush Control in Creosotebush Communities. Journal of Range Management 44:133-136.

Renard, K. G., G. R. Foster, G. A. Weesies, and J. P. Porter. 1991. RUSLE - Revised Universal Soil Loss Equation. Journal of Soil and Water Conservation 46:30-33.

Simanton, J. R., M. A. Weltz, and H. D. Larsen. 1991. Rangeland Experiments to Parameterize the Water Erosion Prediction Project Model: Vegetation Canopy Effects. Journal of Range Management 44:276-281.

1990

Drungil, C. E. C., R. H. McCuen, and J. R. Simanton. 1990. Application of Low Altitude Photogrammetry to the Determination of Rangeland

Hydraulic Parameters. Transactions of the American Society of Agricultural Engineers 33:1919-1924.

Econopouly, T. W., D. R. Davis, and D. A. Woolhiser. 1990. Parameter Transferability for a Daily Rainfall Disaggregation Model. Journal of Hydrology 118:209-228.

Emmerich, W. E. 1990. Precipitation Nutrient Inputs in Semiarid Environments. Journal of Environmental Quality 19:621-624.

Osborn, H. B., J. R. Simanton. 1990. Hydrologic Modeling of Treated Rangeland Watersheds. Journal of Range Management 43:474-481.

Woolhiser, D. A., R. E. Smith, and D. C. Goodrich. 1990. KINEROS: A Kinematic Runoff and Erosion Model: Documentation and User Manual. USDA Agricultural Research Service, ARS-77, 130 pp.

1989

Emmerich, W. E., D. A. Woolhiser, and E. D. Shirley. 1989. Comparison of Lumped and Distributed Models for Chemical Transport by Surface Runoff. Journal of Environmental Quality 187:120-126.

Frasier, G. W. 1989. Characterization of Seed Germination and Seedling Survival During the Initial Wet-Dry Periods Following Planting. Journal of Range Management 42:299-303.

Johnsen, T. N., Jr., and H. L. Morton. 1989. Tebuthiuron Persistence and Distribution in Some Semiarid Soils. Journal of Environmental Quality 18:433-438.

Nearing, M. A., D. I. Page, J. R. Simanton, and L. J. Lane. 1989. Determining Erodibility Parameters from Rangeland Field Data for a Process-based Erosion Model. Transaction of the American Society of Agricultural Engineers 32:51-56.

Osborn, H. B., J. R. Simanton. 1989. Gullies and Sediment Yield. Rangelands 11:51-56.

1988

Blau, J. B., D. A. Woolhiser, L. J. Lane. 1988. Identification of Erosion Model Parameters. Transactions of the American Society of Agricultural Engineers 31:839-845, 854.

Woolhiser, D. A., C. L. Hanson, and C. W. Richardson. 1988. Microcomputer Program for Daily Weather Simulation. USDA Agricultural Research Service, ARS-75, 49 pp.

1987

- Boughton, W. C., K. G. Renard, and J. J. Stone. 1987. Flood Frequency Estimates in Southeastern Arizona. *Journal of the Irrigation and Drainage Division, American Society of Civil Engineers* 113(ID4):469-478.
- Frasier, G. W., J. R. Cox, and D. A. Woolhiser. 1987. Wet-Dry Cycle Effects on Warm-Season Grass Seedling Establishment. *Journal of Range Management* 40:2-6.
- Herrenhorn, J. S., and D. A. Woolhiser. 1987. Disaggregation of Daily Rainfall. *Journal of Hydrology* 95:299-322.
- Todorovic, P., D. A. Woolhiser, and K. G. Renard. 1987. Mathematical Model for Evaluation of the Effect of Soil Erosion on Soil Productivity. *Hydrological Processes* 1:181-198.

1986

- Osborn, H. B., and J. R. Simanton. 1986. Gully Migration on a Southwestern Rangeland Watershed. *Journal of Range Management* 39:558-561.
- Simanton, J. R., and G. L. Jordan. 1986. Early Root and Shoot Elongation of Selected Warm-Season Perennial Grasses. *Journal of Range Management* 39:63-67.

1985

- Boughton, W. C., and J. J. Stone. 1985. Variation of Runoff with Watershed Area in a Semiarid Location. *Journal of Arid Environments* 9:13-25.
- Frasier, G. W., J. R. Cox, and D. A. Woolhiser. 1985. Emergence and Seedling Response of Seven Warm-Season Grasses for Six Wet-Dry Sequences. *Journal of Range Management* 38:372-377.
- Snyder, J. K., and D. A. Woolhiser. 1985. Effects of Infiltration on Chemical Transport into Overland Flow. *Transactions of the American Society of Agricultural Engineers* 29:1450-1457.
- Williams, J. R., and K. G. Renard. 1985. Assessment of Soil Erosion and Crop Productivity with Process Based Models (EPIC). In: Folliott, R. F., and B. A. Steward, eds. *Soil Erosion and Crop Productivity*. ASA, CSSA, and SSSA, Madison, Wisconsin, pp. 67-103.

- Woolhiser, D. A., and H. B. Osborn. 1985. A Stochastic Model of Dimensionless Thunderstorm Rainfall. *Water Resources Research* 21:511-522.

OTHER IMPORTANT REFERENCES

- Diskin, M. H., and L. J. Lane. 1972. A Basinwide Stochastic Model for Ephemeral Stream Runoff in Southeastern Arizona. *Bulletin (IASH)* 17:61-76.
- Frasier, G. W., and L. E. Myers. 1983. *Handbook of Water Harvesting*. USDA Agricultural Research Service, Agricultural Handbook 600, 45 pp.
- Knisel, W. G., ed. 1980. *CREAMS: A Field-scale Model for Chemicals, Runoff, and Erosion from Agricultural Management Systems*. USDA-SEA, Conservation Research Report 26, 643 pp.
- Osborn, H. B. 1983. *Precipitation Characteristics Affecting Hydrologic Response of Southwestern Rangelands*. USDA Agricultural Research Service, ARM-W-34.
- Osborn, H. B., L. J. Lane, and V. A. Meyers. 1980. Rainfall-Watershed Relationships for Southwestern Thunderstorm. *Transactions of the American Society of Agricultural Engineers* 23:82-87.
- Osborn, H. B., K. G. Renard, and J. R. Simanton. 1979. Dense Networks to Measure Convective Rainfall in the Southwestern United States. *Water Resources Research* 15:1701-1711.
- Reich, B. M., and K. G. Renard. 1981. Application of Advances in Flood Frequency Analysis. *Water Resources Bulletin* 17:67-74.
- Renard, K. G. 1970. *The Hydrology of Semiarid Rangeland Watersheds*. USDA Agricultural Research Service, ARS 41-162.
- Renard, K. G. 1977. *Past, Present, and Future Water Resources Research in Arid and Semiarid Areas of the Southwestern United States*. 1977 Hydrology Symposium, Australian Institution of Engineers, Brisbane, Australia, pp. 1-29.
- Renard, K. G., and E. M. Laursen. 1975. A Dynamic Behavior Model of an Ephemeral Stream. *Journal of the Hydraulics Division, American Society of Civil Engineers* 101(HY5):511-528.
- Smith, R. E., D. L. Chery, Jr., K. G. Renard, and W. R. Gwinn. 1982. *Supercritical Flow Flumes for Measuring Sediment-laden Flow*. USDA Agricultural Research Service, Technical Bulletin 1655, 70 pp.