

7-1969

Water Resources News, Volume 1, No. 3, July 1969

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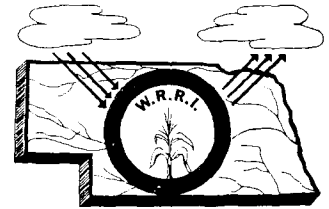
"Water Resources News, Volume 1, No. 3, July 1969" (1969). *Water Current Newsletter*. 35.
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WATER RESOURCES NEWS

NEBRASKA WATER RESOURCES RESEARCH INSTITUTE
212 AGRICULTURAL ENGINEERING BUILDING

THE UNIVERSITY OF NEBRASKA
LINCOLN, NEBRASKA 68503



Volume 1 Number 3

July, 1969

EVAPOTRANSPIRATION SEMINAR

During the period June 25-27, 1969, the Mid America Water Resources Research Institutes held their Second Evapotranspiration Conference at the Nebraska Center. The primary emphasis of the meeting was on instrumentation problems. Scientists from 12 states participated in the program. The principal speaker was Dr. R. J. Hanks of the Department of Soils and Meteorology at Utah State University.

LEGISLATION OF INTEREST

S. 2112 is a bill to create a Department of Conservation and Environment. The intent is to transfer many functions throughout government (HEW, Agricultural, Interior) which relate to conservation and environment to the new department. The impact would be felt by almost every department.

PUBLICATIONS OF INTEREST

1. "Water Levels in Observation Wells in Nebraska 1968", Nebraska Water Survey Paper No. 24., available from the Conservation and Survey Division, University of Nebraska, Lincoln, Nebraska 68508.
2. "Water Resources Investigations in Nebraska 1969", U. S. Department of the Interior, Geological Survey, available through the District Chief, Water Resources Division, U.S.G.S., Room 127 Nebraska Hall, Lincoln, Nebraska 68508.

DATA BANK BILL PASSED

Legislative Bill 384 to authorize the Nebraska Soil and Water Conservation Commission to establish a data bank was passed. The bill provides for the collection and interpretation of basic data in the fields of soil and water resources. When

completely operational, the data bank should be a great asset to all water resources efforts in the state.

PHREATOPHYTE RESEARCH GRANT OBTAINED

The NWRRI and the U. S. Bureau of Reclamation have completed arrangements for the funding of a study of the phreatophyte communities of the Republican River in Nebraska. Phreatophytes are plants whose roots can reach ground water or the capillary fringe above a water table. Dr. Patricia J. Rand, Assistant Professor of Botany, is the principal investigator.

The objectives of the project are:

1. To determine by accepted survey methods the numbers and kinds of woody phreatophyte vegetation growing on the floodplain of the Republican River in Nebraska and to estimate the amounts and kind of vegetation on the major tributaries of this stretch of river.
2. To ascertain the structure of the floodplain plant communities by measuring vegetation cover and other attributes along transect lines set at right angles to the stream channel, the transects to be located using accepted statistical and ecological procedures and to be permanently marked for reference.
3. To prepare a map of the plant communities of the river valley and immediate surroundings.
4. To determine if vegetation distribution is associated with some physical parameter of the stream channel. In this preliminary study, soil samples will be taken in representative stands and analyzed for particle size distribution and water content.
5. To estimate water usage of the phreatophyte communities using data on water consumption and loss obtained from other sources in the southwestern United States where detailed studies are being conducted and applying these data to the Republican River situation. No experimental data on water usage by the phreatophytes will be collected in the present study.

It is expected that this initial project will become the vehicle for launching an expanded research effort relative to phreatophytes and their impact on the water resources of the state.

OWRR FISCAL YEAR 1970 TITLE II PROGRAM

Secretary of the Interior Walter J. Hickel has announced the selection of 36 research projects for the fiscal year 1970 water research program authorized under Title II of the Water Resources Research Act of 1964.

The Title II program -- administered by the Office of Water Resources Research -- provides for grants, contracts, or other arrangements with educational institutions, private foundations or other institutions, and with private firms and individuals.

The purpose of such grants, contracts or other arrangements, is to provide financial support of research into any aspects of water problems related to the missions of the Department of the Interior which are not otherwise being studied.

In the research projects selected for support, emphasis was given to research related to urban and metropolitan water problems and to the development and application of systems analysis to water resources problems.

A list of the proposed research awards follows:

New Mexico State University, Las Cruces, New Mexico -- Soil and Water Management for Salinity Control - \$46,223

Cornell University, Ithaca, New York -- Metropolitan Water Resources Systems Analysis - \$67,255

Kansas State University, Manhattan, Kansas -- Modeling and Optimization of Water Resources Systems, Phase II - \$36,650

Michigan State University, East Lansing, Michigan -- An Ecological Evaluation of Stream Eutrophication - \$73,604

Georgia Institute of Technology, Atlanta, Georgia -- Case Study of Remedial Flood Management in an Urban Area, Phase II - \$60,000

Oregon State University, Corvallis, Oregon -- Computer Simulation of Eutrophication - \$29,000

Desert Research Institute, Reno, Nevada -- Research and Analysis to Plan, Develop, and Manage a Ground and Surface Water Supply, Phase II - \$55,000

Desert Research Institute, Reno, Nevada -- Application of Simulation Theory to Water Resources Planning and Management - \$60,000

University of New Hampshire, Durham, New Hampshire -- Economic Evaluation of Various Uses and Cost Allocation of Surface Water Resources - \$48,716

University of Michigan, Ann Arbor, Michigan -- Systems Analysis of the Great Lakes - \$72,082

Barnard College, Columbia University, New York, New York -- Coordinated Management and Design of Metropolitan Water Supply and Waste Water Disposal Networks: A Linked Systems Analysis - \$79,202

Stanford University, Stanford, California -- Evaluation of the Decision Process in Water Resource Planning - \$38,954

University of California, Riverside, California -- Optimization of Water Resources Development: Phase III - Optimization of Capacity Specifications for Components of Regional Complex Integrated Multipurpose Water Resource Systems - \$49,886

Union College, Schenectady, New York -- Continuation of Stochastic Basis for Comprehensive River Basin Planning - \$18,256

Massachusetts Institute of Technology, Cambridge, Massachusetts -- Optimum Linear Synthesis in Urban Hydrology - \$38,461

Massachusetts Institute of Technology, Cambridge, Massachusetts -- A Problem Oriented Language for Hydrologic Analysis - \$49,345

Rensselaer Polytechnic Institute, Troy, New York -- Diatom Population Changes in Lake George: Phase II - \$47,000

George Washington University, Washington, D. C. -- Implementation of Water Resources Plans in Metropolitan Environments - \$16,845

Antioch College, Yellow Springs, Ohio -- Evaluation of Natural River Environments - \$23,367

Hofstra University, Hempstead, New York -- Evaluation of Recreational and Cultural Benefits of Estuarine Use in an Urban Setting - \$45,063

University of Chicago, Chicago, Illinois -- Water as a Potential Organizing Concept in Urban Regions - \$75,000

University of Illinois, Urbana, Illinois -- Statistical Geometry of Porous Media - \$21,170

Texas Water Development Board, Austin, Texas -- Stochastic Optimization and Simulation Techniques for Management of Regional Water Resource Systems - \$85,000

Huron River Watershed Council, Ann Arbor, Michigan -- Coordination of Public and Private Forces on Inland Lake and Shoreland Management - \$63,100

Institute of Marine Science, Miami, Florida/Conservation Foundation, Washington, D. C. -- Water Cycles, Water Resources Planning, and Urban Development at Rookery Bay, Florida - \$78,546

American Society of Civil Engineers, New York, New York -- Systematic Study and Development of Long-Range Programs of Urban Water Resources Research - \$50,000

Ralph Stone and Co., Inc., Los Angeles, California -- Socio-Economic Study of Multiple Use Water Supply Reservoir - \$60,000

Hydronautics, Inc., Laurel, Maryland -- Experimental and Theoretical Study of the Hydrodynamics of Dispersion in Rivers and Estuaries - \$60,000

General Electric Co., Philadelphia, Pennsylvania -- Mathematical Modeling of Water Distribution Systems - \$81,828

Engineering Science Inc., Arcadia, California -- Decision Process in Water Quality Management - \$80,000

General Electric Co., Santa Barbara, California -- Mathematical Modeling of Fresh Water Aquifers Having Salt Water Bottoms - \$60,000

Leeds, Hill & Jewett, San Francisco, California -- Economic and Institutional Analysis of a Waste Water Reclamation and Reuse Project - \$69,834

Battelle Memorial Institute, Columbus, Ohio -- Evaluating Urban Core Usage of Waterways and Shorelines - \$68,013

Morton W. Bittinger and Associates, Fort Collins, Colorado -- Integrated Management and Administration of Ground Water in Interstate and International Aquifers - \$37,600

AVCO Economic Systems Corp., Washington, D. C. -- A Multi-Phasic Component Study to Predict Storm Water Quality from Urban Areas - \$80,000

Hittman Associates, Inc., Columbia, Maryland -- Factorial Analysis of Price - Demand and Demand - Cost Functions for Municipal Water Systems - \$75,000

RESEARCH REVIEW

Project Title: Internal Water Status of Plants
Principal Investigators: Dr. Jerry D. Eastin
Dr. Charles Y. Sullivan
Dr. E. J. Kinbacher
Dates: July 1965 to June 1969
Project Completed

The objectives of this research were to: (1) investigate the influence of internal water stress on physiologic process rates essential to the maintenance and development of plants; and (2) investigate the influence of water stress on the CO₂ fixation enzyme.

Sorghum [*Sorghum bicolor* (L.) Moench] was chosen as a test plant since it has the capability to produce under moderate heat and moisture stress conditions. Sorghum can also persist for considerable periods under severe stress and grow again to maturity once stress is alleviated. Carbon dioxide exchange was monitored in the light and dark to obtain respective estimates of photosynthesis and respiration as water stress increased.

Significant findings follow:

- (1) An increase in leaf resistance occurred between the turgid condition (0.27 min cm⁻¹) and a water potential in the 20 atmosphere range (0.51 min cm⁻¹). As water potential approached 24 atmospheres diffusivity dropped sharply (2.28 min cm⁻¹).
- (2) Reductions in CO₂ uptake of well over 50 percent occurred at water potentials approaching 20 atmospheres. Plants usually were near the compensation point at 20 atmospheres and increased water stress from that point frequently was associated with small net CO₂ loss in the light.
- (3) Dark respiration rates, as estimated by CO₂ evolution, were similar under turgid and severely stressed (>25 atmospheres) conditions. Respiration rates at intermediate levels (about 20 atmospheres) were about twice those at fully turgid and more severely stressed conditions.
- (4) Dark CO₂ fixation was noted on several occasions in stressed plants.

- (5) Activities were determined for phosphoenolpyruvic (PEP) carboxylase (CO₂ fixation enzyme) extracted from plants at several water potentials. Activity of the enzyme decreased somewhat with severe stress but still remained comparatively high.
- (6) Phosphoenolpyruvic carboxylase was found in mitochondria, a respiratory organelle, as well as in chloroplasts and appeared not to be highly bound to either organelle.

Increases in leaf resistance values correlate with increasing water stress and a progressive decline in CO₂ uptake in the light. Since activity of the carboxylating enzyme remains fairly high as stress increases, the increased leaf resistance appears mainly to be limiting CO₂ uptake. However, one cannot be certain how closely in vivo enzyme activity corresponds to in vitro values.

Dark CO₂ fixation appears significant, especially in view of carboxylating enzyme activity in the mitochondria. The combination of these facts leads one to speculate that mitochondria may be important in recycling of respired CO₂ and therefore function to conserve carbon skeleton especially under stress conditions when stomates are closed tightly to avoid water loss. Under such conditions respired CO₂ is the only CO₂ source available for fixation and maintenance of the stressed plant. This complex aspect of the investigation warrants a great deal more investigation.

Information of the type produced by this project is needed to provide answers to many questions which relate to transpiration losses. Before proper controls can be designed, the plant mechanisms themselves must be better understood.

NEWSLETTER ITEMS

Newsletter items and inquiries should be sent to: Dr. Warren Viessman Jr., Director, Water Resources Research Institute, 212 Agricultural Engineering, East Campus.