The Ogallala Aquifer,
"Managing for Drought and Climate Change"

1997 Nebraska Water Conference

March 10-12 1997
The Cornhusker Hotel
Burnham Yates Convention Center
Lincoln, Nebraska
Table of Contents
The Great Plains Symposium 1997

The Ogallala Aquifer,
"Managing for Drought and Climate Change"
26th Annual Nebraska Water Conference
Cornhusker Hotel, Lincoln, NE

Credits........................................................................................................................................2
Program.........................................................................................................................................3
Exhibitors.......................................................................................................................................7
Pioneer Award Winners......................................................................................................................8
Progress Award Winners...................................................................................................................9
Kremer Groundwater Achievement Award Winners.................................................................10
Profiles of 1997 Award Winners....................................................................................................11
Speakers.........................................................................................................................................12
Speaker Abstracts..............................................................................................................................19
Nebraska's Natural Resources Districts..........................................................................................23
Water Information on the World Wide Web ..................................................................................24

Cover Photo
The program's cover photo appears on the cover of Roger Welsch's "The Summer It Rained: Water and Plains Pioneer Humor," first published in 1978. The book was reprinted for this conference. The photograph originally appeared in "Drought and Rainmaking in Nebraska in 1894." The caption under the picture at that time said the men were setting up rainmaking equipment, though an exact date and location are unknown. (Photograph and information courtesy of the Nebraska State Historical Society).
Credits

Conference Sponsors

Nebraska Water Conference Council
Department of Agricultural Meteorology
Conservation and Survey Division
Water Center/Environmental Programs
Institute of Agriculture and Natural Resources
University of Nebraska-Lincoln
The Great Plains Foundation
The Groundwater Foundation

Special Contributors

Central Nebraska Public Power and Irrigation District
Farmers National Co.
Lindsay Manufacturing
Valmont Irrigation

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Bob Kuzelka and Karen Stork

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Rollin Hotchkiss, Mike Jess, Karren Kerr, Don Kraus, Bob Kuzelka,
Virginia McGuire, Darrell Nelson, Bill Powers, Geraldine Rueter, Larry Stitzman,
Karen Stork, Perry Wigley, Don Wilhite, Dayle Williamson, Randolph Wood

Conference Program Subcommittee

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Lori Triplett, Dale Vagts, Ed Vitzthum, Perry Wigley, Dayle Williamson, Kent Zimmerman

Conference Support

Chris Grant, Tricia Liedle, Jerry Vandersnick, Jacki Vogel
Program

Monday, March 10

5 to 9 p.m. Early Registration in the Atrium
6 to 8 p.m. Reception and exhibits in the Atrium
(See page 7 for list of exhibitors)
Drought and climate change videos in Grand Ballroom C

Tuesday, March 11

7:30 a.m. Registration and exhibits, plus coffee and muffins in the Atrium
(Morning sessions in Grand Ballrooms D, E and F)

Session I: Management Influences
(Moderated by Susan Seacrest, President, The Groundwater Foundation)

8:30 a.m. Welcome, James C. Moeser, Chancellor, University of Nebraska-Lincoln
8:40 a.m. Geologic and Hydrologic Overview of the Aquifer, Jim Goeke, Conservation and Survey Division, UNL, North Platte
9:25 a.m. Drought: A Normal Part of Great Plains Climate, Don A. Wilhite, National Drought Mitigation Center, UNL
10:10 a.m. Break and Exhibits
10:20 a.m. How Climate Change May Affect the Dependency of Great Plains Agriculture on Water Resources, William E. Easterling, Great Plains Regional Center for Global Environmental Change, UNL
11:05 a.m. Drought and Climate Change: Economic and Social Consequences, Dennis U. Fisher, Texas Agricultural Extension Service, Texas A&M University

NOON Luncheon in Grand Ballroom A, B and C
(presiding, Bob Volk, Secretary/Treasurer, Nebraska Water Conference Council)
Conference Challenge, Norm Rosenberg, Battelle Pacific Northwest National Laboratory, Washington D.C.
Session II: Management Responses
(See pages 19-22 for abstracts of papers that will be presented)

Track I
(Grand Ballroom D)
(Moderated by J. Michael Jess, Director, Nebraska Department of Water Resources)

1:30 p.m. "Public and Private Responses to Great Plains Drought," Francis Moul, retired editor and publisher


3 p.m. "Possible Impacts of Global Warming on Hydrology of the Ogallala Aquifer Region," Norm Rosenberg

3:45 p.m. Break and exhibits

Track II
(Grand Ballroom E)
(Moderated by Duane Eversoll, Associate Director, Conservation and Survey Division, UNL)

1:30 p.m. "Natural Responses of Shallow Lakes and Wetlands to Climatic/Environmental Change: Focus on the Nebraska Sandhills," David C. Gosselin, Conservation and Survey Division, UNL

2:15 p.m. "A Successful Water Conservation Program in a Semi-Arid Region of Nebraska," Don Adelman, Nebraska Natural Resources Commission and Allen Dutcher, Department of Agricultural Meteorology, UNL

3 p.m. "Limited Irrigation Management Strategies," Joel P. Schneekloth and Norman Klocke, West Central Research and Extension Center, UNL, Clay Center

3:45 p.m. Break and exhibits

Track III
(Grand Ballroom F)
(Moderated by R.L. "Gus" Hughbanks, Assistant State Conservationist, USDA Natural Resource Conservation Service)

1:30 p.m. "A Good Example for Aquifer Management in the 21st Century," Amara Tandy Brook, National Center for Atmospheric Research, Environmental and Societal Impacts Group, Boulder, CO
2:15 p.m. "The Texas High Plains Ogallala Area Water Management Plan," Lee Arrington, South Plains Underground Water Conservation District, Brownfield, TX

3 p.m. "Economic Impacts of Streamflow and Irrigation in the Frenchman Creek Basin," Osei Yeboah, Department of Agricultural Economics, UNL

3:45 p.m. Break and Exhibits

Session III: Sustainable Management

4 p.m. Eight concurrent group sessions introduced and facilitated by representatives from the eight states in the Ogallala Aquifer region. Each will present their state's perspective on the question of what management policies and research are necessary to achieve regional sustainability beyond the years 2015 and 2035. Each state representative will then prepare a brief perspective on the question for presentation at the 8:10 a.m. plenary session on Wednesday, March 12.

Room assignments, by state, and facilitators for these sessions are:

- **Colorado**, Purushottam Dass, meeting room 318
- **Kansas**, Wayland J. Anderson, Grand Ballroom E
- **Nebraska**, Dayle Williamson, Grand Ballroom D
- **New Mexico**, Mustafa Chudnoff, meeting room 618
- **Oklahoma**, Mark Belden, Garratt rooms I&II
- **South Dakota**, Jim Goodman, meeting room 518
- **Texas**, Lee Arrington, Grand Ballroom F
- **Wyoming**, Richard C. Stockdale, meeting room 418

1. These rooms are in the hotel building in the southeast corner of their respective floors.
2. These rooms are on the first floor of the convention center.

6:00 p.m. Social Hour in the Atrium

7 p.m. Awards Banquet in Grand Ballrooms A, B and C (presiding, Everett Vogel, immediate past chair, NWCC)

Pioneer Award (presented by the NWCC), see page 8

Progress Award (presented by the NWCC), see page 9

Maurice Kremer Groundwater Achievement Award (presented by The Groundwater Foundation), see page 10

Entertainment Roger Welsch (introduced by Millard W. Hall, former director of the Water Center, UNL)
Wednesday, March 12

7 a.m. **Buffet Breakfast** in Grand Ballrooms A, B and C
(presiding, Dayle Williamson, Director, Nebraska NRC)
(Presentation of 25-year recognition plaques to Nebraska's Natural Resources Districts by Hazel Jenkins, NRC retired and Irvin T. Omtvedt, IANR Vice Chancellor and Interim Senior Vice Chancellor for Academic Affairs, UNL), see page 23

**Session IV: Management Perspectives**
(Moderated by Linda Weiss, Nebraska District Chief, USGS)

8:10 a.m. **Group Session Perspectives** presented by the eight Ogallala Aquifer region state facilitators (Dass, Anderson, Williamson, Chudnoff, Belden, Goodman, Arrington and Stockdale). See notes under Session III for more information.

9:30 a.m. **Break and Exhibits**

10 a.m. **Agricultural Producer Perspective**, Bob Bettger, Fairmont

10:30 a.m. **Manufacturer Perspective**, Curt Clausen, Pioneer Hi-Bred International, Lincoln

11 a.m. **Food Processor Perspective**, Wes Potter, Monfort Headquarters, ConAgra, Greeley, CO

11:30 a.m. **Government Perspective**, E. Benjamin Nelson, Governor, State of Nebraska

NOON **Luncheon**, in Grand Ballrooms A, B and C
(presiding, Don Kraus, Vice Chair, NWCC)
**Conference Wrap-up**, Lori Triplett, President, The Great Plains Foundation, Overland Park, KS

1:30 p.m. **Conference Adjourns**
Exhibitors

The Great Plains Foundation

The Groundwater Foundation

Nebraska Association of Resources Districts (NARD)

United States Geological Survey (USGS)

University of Nebraska-Lincoln

Center for Sustainable Agriculture

Conservation and Survey Division

Cooperative Extension Service

Department of Textiles, Clothing and Design

Department of Biological Systems Engineering

High Plains Climate Center

National Drought Mitigation Center

Water Center/Environmental Programs
# Pioneer Award Winners

*(The Pioneer Award is presented annually by the NWCC to an individual with outstanding accomplishments in the water resources area)*

<table>
<thead>
<tr>
<th>Year</th>
<th>Name</th>
<th>Location</th>
</tr>
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<tbody>
<tr>
<td>1997</td>
<td>Ray Bentall</td>
<td>Lincoln</td>
</tr>
<tr>
<td>1996</td>
<td>Richard C. Hahn</td>
<td>Omaha</td>
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<tr>
<td>1995</td>
<td>Leslie F. Sheffield</td>
<td>Lincoln</td>
</tr>
<tr>
<td>1994</td>
<td>Wesley Sell</td>
<td>Scottsbluff</td>
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<tr>
<td>1993</td>
<td>Harold M. Stevens</td>
<td>Lexington</td>
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<tr>
<td>1992</td>
<td>Paul Hohnstein</td>
<td>Hastings</td>
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<tr>
<td>1991</td>
<td>William E. Splinter</td>
<td>Lincoln</td>
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<tr>
<td>1990</td>
<td>Deon D. Axthelm</td>
<td>Springfield, MO (formerly Lincoln)</td>
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<tr>
<td>1989</td>
<td>Homer Loutzenheiser</td>
<td>North Platte</td>
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<td>1988</td>
<td>Robert B. Crosby</td>
<td>Lincoln</td>
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<tr>
<td>1987</td>
<td>Vincent Dreeszen</td>
<td>Lincoln</td>
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<td>1986</td>
<td>Paul Fischbach</td>
<td>Lincoln</td>
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<tr>
<td>1985</td>
<td>Robert Daugherty</td>
<td>Valley</td>
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<tr>
<td>1984</td>
<td>Vance Anderson</td>
<td>Hastings</td>
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<td>1983</td>
<td>Alfred Drayton</td>
<td>O'Neill</td>
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<td>1982</td>
<td>Senator Maurice A. Kremer</td>
<td>Lincoln</td>
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<tr>
<td>1981</td>
<td>Clyde Burdick</td>
<td>Ainsworth</td>
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<td>1980</td>
<td>Henry G. Lange</td>
<td>Ord</td>
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<td>1979</td>
<td>Cyril P. Shaughnessy</td>
<td>St. Paul</td>
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<td>1978</td>
<td>Larry E. Donegan</td>
<td>Lincoln</td>
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<td>1977</td>
<td>Durward B. Varner</td>
<td>Lincoln</td>
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<td>1976</td>
<td>Dan S. Jones, Jr.</td>
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<td>1975</td>
<td>R. Erle Campbell</td>
<td>Lincoln</td>
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<tr>
<td>1974</td>
<td>Eugene C. Reed</td>
<td>Lincoln</td>
</tr>
<tr>
<td>1973</td>
<td>Frank Zybach</td>
<td>Columbus</td>
</tr>
</tbody>
</table>
Progress Award Winners
(The Progress Award is presented annually by the NWCC to a group, agency or organization with outstanding accomplishments in the water resources area)

1997 Central Nebraska Regional Water Conservation Task Force
1996 Missouri River Division, U.S. Army Corps of Engineers, Omaha
1995 Nebraska League of Women Voters, Lincoln
1994 Management Systems Evaluation Area (MSEA) Team, Lincoln
1993 Nebraska State Irrigation Association, Lincoln
1992 Nebraska Groundwater Foundation, Lincoln
1991 Five Nebraska Center-Pivot Irrigation Equipment Manufacturers:
  - Valmont Industries Inc., Valley
  - Lindsay Manufacturing Co., Lindsay
  - Reinke Manufacturing Co., Deshler
  - T-L Irrigation Co., Hastings
  - Lockwood Corp., Gering
1990 Burlington-Northern Railroad Foundation, Ft. Worth, TX, and Burlington-Northern Railroad, Lincoln
1989 Papio-Missouri River Natural Resources District, Omaha
1988 Nebraska Well Drillers Association, Lincoln
1987 Twin Loups Reclamation District, Ord, and Twin Loups Irrigation District, Scotia
1986 North Platte Region, Nebraska Public Power District, North Platte
1985 Nebraska Farmer magazine, Lincoln, and the Agricultural Institute of Nebraska, Grand Island
1984 Little Blue Natural Resources District, Davenport
1983 Upper Republican Natural Resources District, Imperial
1982 Ainsworth Irrigation District, Ainsworth
1981 Nebraska Water Resources Association, Lincoln
1980 Frenchman-Cambridge Irrigation District
1979 Lower Elkhorn Natural Resources District, Norfolk
1978 Custer Public Power District, Broken Bow
1977 Central Platte Natural Resources District, Grand Island
1976 Republican Valley Conservation Association, McCook
1975 Central Nebraska Public Power and Irrigation District, Holdrege
1974 Gering-Ft. Laramie Irrigation District, Gering
1973 Blue River Association of Groundwater Conservation Districts (Clay, Hamilton, Seward and York Counties GWCD), Aurora
The Maurice Kremer Groundwater Achievement Award

presented by The Groundwater Foundation

From its beginning in 1985, The Groundwater Foundation has sought to recognize excellence in groundwater management. The Foundation Trustees intended the Maurice Kremer Groundwater Achievement Award to represent their highest accolade and be reserved for those rare individuals who had created a beneficial legacy of groundwater-related service in the State of Nebraska. The award was named for Nebraska State Senator Maurice Kremer in 1990. Kremer exemplified commitment to education, partnerships and service. The Kremer winners represent such diverse fields as education, research, public health, groundwater-related industries, government service and public policy.

1997 Robert B. Daugherty
1996 Frank A. Smith
1995 Fred Salmon and Family
1994 Virginia Smith
1993 Robert Crosby
1992 Ted Filipi
1991 Ralph Marlette
1990 Warren Fairchild
1989 Val Kuska
1988 Eugene Reed
1987 Maurice Kremer
1986 Vincent Dreeszen
Profiles of 1997 Award Winners

Ray Bentall receives the 1997 Pioneer Award of the Nebraska Water Conference Council (NWCC). Bentall distinguished himself in a career in natural resources that included 30 years as a USGS hydrologist and geologist. He retired from the USGS in 1982 to join UNL’s Conservation and Survey Division (CSD), being promoted to associate professor prior to retiring from the division in 1992. During his tenure at CSD, Bentall published resource atlases and reports on the Elkhorn River Basin, the Platte River, and availability and use of water in Nebraska, among many others. His publications were among the first to formally recognize the connection between surface water and groundwater. Since retirement he has continued to ask the questions and discern the answers for little or no compensation or acclaim. Thanks in large part to his efforts, Nebraska has formally recognized the connection between surface water and groundwater that we now term "conjunctive use."

The Central Nebraska Regional Water Conservation Task Force receives the 1997 Progress Award of the NWCC. The Task Force is a 13-member advisory committee representing agricultural, economic, municipal, recreational and wildlife interests. Its formation by the Central Nebraska Public Power and Irrigation District was an innovative approach to develop comprehensive and integrated plans to manage, preserve and protect the area's surface water and groundwater resources. The multidisciplinary nature of the Task Force's membership promotes cooperative approaches to integrated management of surface water and groundwater benefiting residents in central Nebraska's Gosper, Keith, Phelps, Lincoln, Kearney, Dawson and Adams Counties.

Robert B. Daugherty is the winner of the 1997 Maurice Kremer Groundwater Achievement Award of the Groundwater Foundation, Lincoln. Daugherty founded Valmont Industries and enhanced development of the center-pivot irrigation technology in such widespread use today. His selection to receive the Maurice Kremer Groundwater Achievement Award was based on the clear and broad-based benefits his efforts have brought to Nebraska, and the value that agricultural efficiency and prosperity brings to any region that implements it. Daugherty's pioneering work and the excellence of Valmont products have made a lasting, positive contribution to both water quality and water conservation worldwide.
Speakers

**Don Adelman** is a water resources engineer with the Nebraska Natural Resources Commission. He earned BS and MS degrees from the University of Nebraska-Lincoln, where he currently is a PhD student in the Civil Engineering department. Adelman has authored, coauthored and contributed to some 40 papers on areas such as nitrate and viral contamination of groundwater, soil and water conservation, as well as water use and water resources planning. He has been with the NNRC for the past 21 years and a registered civil engineer in Nebraska for the past 19 years.

**Wayland J. Anderson** has been assistant chief engineer at the division of water resources, Kansas Department of Agriculture since 1984. Anderson currently serves as a technical advisor to the Kansas Ogallala Task Force and participates in the governor's reinventing Kansas government work group and Kansas quality management implementation activities. He is a registered professional engineer in Kansas, Colorado and Wyoming and has been involved in water rights administration and development since 1973. Anderson earned BS and MS degrees in agricultural engineering from the University of Wyoming in 1971 and 1973.

**Lee Arrington** has managed Texas' South Plains Underground Water Conservation District since its inception in 1993. He also administers the Agricultural Conservation Equipment Loan Program which has placed $3.2 million in the hands of producers for purchase of irrigation equipment over the past four years. Arrington serves on the executive board of the High Plains Ogallala Regional Water Management Plan, is secretary of the Texas Alliance of Groundwater Districts and a board member of the Texas Water Conservation Association. He earned a BS degree in Wildlife and Fisheries Sciences from Texas A&M University.

**Mark Belden** is senior water resources geologist for division/section planning and management/technical studies with the Oklahoma Water Resources Board. His work has included aquifer yield studies, groundwater mapping, vulnerability studies and management of Oklahoma's groundwater level monitoring network. Belden earned a BS in geology from Oklahoma State University in 1979.

**Robert E. Bettger** farms about 3,800 acres of irrigated seed corn, commercial corn and soybeans as part of a family farming operation near Fairmont that includes his father, Robert (now retired) and brothers Bill and Paul Bettger. He is a Fairmont High School graduate and earned a BS in Mechanized Agriculture from UNL in 1971. Bettger and his wife Sandy have four children.

**Amara Tandy Brook** is a research associate with the Environmental and Societal Impacts Group of the National Center for Atmospheric Research, Boulder, CO. Much of her work has focused on resource problems of the American west, including wolf recovery, golden-cheeked warbler conservation, coastal management and water conflicts. She is particularly interested in interdisciplinary and cooperative approaches to solving environmental and resource problems. Her current research involves local groundwater management in west Texas and rates and processes of global environmental change.

**Mustafa Chudnoff** has been staff hydrologist with the New Mexico State Engineer Office for the past eight years. His duties have included development of a regional groundwater flow model of the Southern High Plains Aquifer and evaluations of water supply...
availability for new subdivisions. Chudnoff earned an MS degree in Water Resources Administration from the University of Arizona in 1982. His work experience in water resources has covered the private sector and local and federal government positions.

**Curt Clausen** has been field sales agronomy manager for the plains sales area of Pioneer Hi-Bred International, Inc. since 1994. The area services Nebraska, northeast Colorado and parts of Wyoming. Clausen joined Pioneer Hi-Bred International as an area agronomist for northeast and north central Nebraska in 1984. He earned a BS in agronomy and agricultural economics in 1977 and MS in agronomy in 1979 from UNL. Clausen is a Grand Island native, now living in Lincoln.

**Purushottam Dass** is a supervising engineer with the Colorado Division of Water Resources where he manages the water supply branch dealing with designated groundwater basins and Colorado's South Platte River Basin. For the past nine years he has served as a staff member for the Colorado Groundwater Commission and has been directly involved with management of the Ogallala Aquifer in Colorado. Dass earned a BSCE from the University of Roorkee in India, an MSCE from the University of Idaho and a PhD in water resources from Colorado State University.

**Allen Dutcher** oversees operations of the climate data resources lab within the department of Agricultural Meteorology at UNL and is president-elect of the American Association of State Climatologists. Dutcher began work with UNL's High Plains Climate Center as a research climatologist in 1989 and was appointed state climatologist for Nebraska in 1991. He maintains an affiliation with the High Plains Climate Center. A Michigan native, Dutcher earned BS in meteorology and MS in agricultural meteorology degrees from Iowa State University in 1985 and 1989.

**William E. Easterling** directs the Great Plains Regional Center of the National Institute for Global Environmental Change and is an associate professor of agricultural meteorology at UNL. Prior to joining UNL's faculty he was a fellow in the Climate Resources Program of Resources for the Future. Easterling's current research focuses on the interactions of human activities with their climatic and biotic environment and the possible effects of climate changes from greenhouse warming on agricultural productivity in marginal environments, such as the north American great plains. Easterling earned a PhD in geography from the University of North Carolina, Chapel Hill and has published widely on the above topics, and many related ones.

**Duane Eversoll** has been associate director of the Conservation and Survey Division at UNL since 1991, ranking as an associate professor there since 1984. He was an assistant professor and research geologist with CSD from 1974-1983 and a geologist with the Nebraska Department of Roads from 1960-1974. Eversoll earned BS and MS degrees in geology from UNL in 1959 and 1977.

**Dennis U. Fisher** is a professor of agricultural economics and extension economist with the Texas Agricultural Extension Service, Texas A&M University. He directs the rural policy program within the economic development program unit of the extension service there. This program provides educational programs and materials on rural development policy issues to rural leaders and government officials and the organizations they represent at the local, state and federal levels. Before joining Texas A&M University, Fisher was on the faculty at Cornell University, Oregon State University and Michigan State University. He received his PhD in agricultural economics from Michigan State University.
Jim Goeke is a professor and research hydrogeologist with the Conservation and Survey Division, UNL at the West Central Research & Extension Center at North Platte. Goeke received his BS in 1966 at the University of Wisconsin and his MS from Colorado State University in 1970. He joined the Conservation and Survey Division in 1970 and was in charge of the test drilling program before transferring to the West Central Research & Extension Center in North Platte in 1976. Since then he has worked on regional groundwater studies involving water quantity and quality in central and southwest Nebraska.

Jim Goodman is responsible for the groundwater section within the water rights program of the South Dakota Department of Environment and Natural Resources. There he manages and develops a statewide well monitoring network of about 1,700 observation wells and is responsible for permitting and regulation of South Dakota groundwater development. Goodman has worked with the State of South Dakota for 20 years, 18 of them with the water rights program. He earned a BS in geological engineering from South Dakota School of Mines and Technology and is a registered professional engineer in South Dakota.

David C. Gosselin is an associate professor and research hydrogeologist in UNL's Conservation and Survey Division. He earned a PhD in geology at South Dakota School of Mines and Technology in 1987, then worked at Battelle Pacific Northwest Laboratory, Richland, WA. Gosselin came to UNL in 1989, first serving northeast Nebraska through CSD's Norfolk office before moving to Lincoln in 1991. His current work emphasizes understanding the dynamics of groundwater and surface water interaction. Gosselin also directs the Nebraska Earth Science Education Network, whose goal is to create a community among Nebraska's K-12 earth science educators.

Millard W. Hall has 30 years experience with university, private and governmental water resources and environmental programs in the U.S. and abroad. He has directed two state water resources research institutes, including the University of Maine Environmental Studies Center (1972-1975) and UNL's Water Resources Center (1975-1978). He was appointed by then president Jimmy Carter as chair of the Missouri River Basin Commission from 1978-1981. Hall has taught water related courses in science and engineering at six universities and has authored or coauthored more than 75 technical publications and presentations. In 1987 he was named founding director of the Florida Center for Solid and Hazardous Waste Management, Gainesville, FL. Hall earned a BS in civil engineering from Vanderbilt University in 1962 and MS and PhD degrees in civil engineering from the University of Illinois in 1963 and 1968. The Georgia native is a professor of civil engineering at FAMU-FSU College of Engineering, Tallahassee, FL.

R.L. "Gus" Hughbanks is assistant state conservationist for field operations for the Natural Resources Conservation Service in Lincoln. Hughbanks began his career with the agency, then known as the Soil Conservation Service, in 1978. During those 18 years he has worked in a number of different positions and in eight locations, ranging from Harrisburg to Falls City and Imperial to David City. Hughbanks graduated from Banner County High School in 1968 and worked the family farm for nearly 10 years before joining the NRCS.

Hazel M. Jenkins is retired from the Nebraska Natural Resources Commission, where she worked for 35 years. When she retired in 1992, the Kansas native had devoted a total of 46 years of service to the State of Nebraska.

J. Michael Jess directs the Nebraska Department of Water Resources. Jess has BS and MS degrees in civil engineering from UNL. He has experience with the Conservation &
Survey Division at UNL; served on active duty with the U.S. Army Corps of Engineers and worked for the Illinois State Water Survey. In 1981 he was appointed to his present position as Director of the Nebraska Department of Water Resources. Jess also chairs the Nebraska Boundary Commission and is secretary of the Missouri River Basin Association. He is a registered professional engineer in both Nebraska and Illinois.

**Norman Klocke** is an extension-research water resources engineer at UNL’s West Central Research and Extension Center at North Platte. He is currently working on more efficient irrigation methods for crop production, including irrigation management, optimum timing of irrigation, crop residue management and suppression of soil evaporation. The Illinois native has worked for NU’s Institute of Agriculture and Natural Resources (IANR) since 1976. Klocke earned a BS degree in Agricultural Engineering from the University of Illinois in 1971; an MS degree in Water Resources Engineering from the University of Kansas in 1976 and a PhD in Irrigation Engineering from Colorado State University in 1983.

**Don Kraus** is general manager of the Central Nebraska Public Power and Irrigation District in south central Nebraska, a position he has held since 1992. The district delivers irrigation to over 100,000 acres, while providing generation from 104 MW of hydrogeneration. Kraus is a registered professional engineer in Nebraska and earned a BS in electrical engineering from UNL in 1971. Kraus has held several engineering, systems and management positions with the CNPPID since 1971.

**James C. Moeser** is chancellor of UNL, where he also ranks as a professor of music. Prior to arriving at UNL, Moeser became vice president for academic affairs and provost of the University of South Carolina in 1992. In 1986 he was appointed dean of the College of Arts and Architecture at Pennsylvania State University. He began his academic career in 1966 at the University of Kansas as assistant professor and chairman of the department of the organ, later being named dean of the School of Fine Arts. In 1984 he was named Althaus Distinguished Professor of Organ, the first academic dean at Kansas ever to be named to a distinguished professorship. Moeser earned a bachelor of music degree with honors (1961) and a master's of music (1964) from the University of Texas at Austin. He completed advanced study in Berlin and Paris under a Fulbright grant and earned a doctor of musical arts at the University of Michigan in 1967. Moeser has an international reputation as a concert organist and actively concertized until 1993.

**Francis Moul** is a retired Nebraska newspaper editor and publisher who is currently enrolled as a PhD candidate in environmental history at UNL. Moul earned a BA in journalism and MA in international relations from South Dakota University in 1964 and 1966 and was a Fulbright scholar to the University of Rajasthan in India in 1966. He embarked on a reporting and editing career in Iowa and later taught political science at Wayne State College. In 1971 Moul and investors purchased the weekly *Syracuse Journal-Democrat*, launching a publishing career that would grow into a $4.5 million business with 120 employees. The Moults sold the business in 1988. He has also been involved in a variety of statewide leadership roles in peace, justice, environmental and political groups. He has chaired three statewide petition drives.

**E. Benjamin Nelson** is governor, State of Nebraska. Nelson has been governor since 1990, having won reelection to a second term in 1994. A McCook native, he earned degrees in logic, philosophy and law from the University of Nebraska. Nelson entered the practice of law in 1970 and was eventually named general counsel, president and chief executive officer for a national insurance group. He also served as executive vice president of the National Association of Insurance Commissioners. In 1975 he was named director
of the Nebraska Department of Insurance. Nelson joined Kennedy, Holland, DeLacy & Svoboda as attorney-of-counsel in 1985. He was co-chair of the National Summit on Federalism in October, 1995. Nelson has chaired the Interstate Oil and Gas Compact Commission of the Western Governors' Conference and been vice chair of the Democratic Governors' Association. He also is past chair of the National Education Goals Panel, the Midwestern Governors' Conference and the Governors' Ethanol Coalition.

**W. Don Nelson** is vice president of public and corporate finance for Smith Hayes Financial Services Corp. and has been a Nebraska investment banker since 1987. Prior to that he was a chief policy advisor for Nebraska Governors Bob Kerrey, J. James Exon and Norbert Tiemann and Wyoming Governor Ed Herschler. He worked for Congressman Doug Bereuter when Bereuter was director of the Nebraska State Office of Planning and Programming in 1969-1971. Nelson graduated from the University of Florida and earned MS and Juris Doctor degrees from Florida State University. He is licensed to practice law in Nebraska, Florida and Wyoming.

**Irvin T. Omtvedt** is vice chancellor for the IANR and interim senior vice chancellor for academic affairs at UNL. Additionally, he is NU vice president for Agriculture and Natural Resources. He joined the faculty at NU in 1975 as head of the Department of Animal Science from Auburn University, where he was assistant dean of agriculture and associate director of the Alabama Agricultural Experiment Station. Omtvedt also spent nine years on the animal science faculty at Oklahoma State University and two years as an extension specialist at the University of Minnesota. Prior to being appointed vice chancellor, he was dean for agricultural research at UNL for five years. The Wisconsin native earned a BS in agriculture from the University of Wisconsin-Madison and MS and PhD degrees in animal science from Oklahoma State University.

**Wes Potter** is vice president of environmental operations for ConAgra Red Meat Companies, which includes 11 different companies. He is a coleader for ConAgra's sustainable development program and has 15 years experience in the livestock industry and 10 years experience in environmental compliance in Colorado. Potter earned BS in geology and MS in environmental biology degrees from the University of Colorado.

**Norm Rosenberg** is chief scientist, integrated earth studies at Battelle Pacific Northwest National Laboratory (PNNL) in Washington D.C. He joined the faculty of UNL's College of Agriculture in 1961 to begin a program in agricultural meteorology, retiring as Professor Emeritus in 1987. In 26 years at UNL Rosenberg conducted research on windbreak effects on crop growth and on photosynthesis and water use in dryland and irrigated agriculture. Much of that research was done at meteorological research facilities he developed at Mead and Scottsbluff. Since 1992, Rosenberg has worked with natural and social scientists at PNNL's Washington D.C. office providing analyses that guide national policy on global environmental change.

**Joel P. Schneekloth** is an extension educator and project manager for the Republican River Valley Limited Irrigation Demonstration Project at NU's West Central Research and Extension Center at North Platte. The project's objectives are to demonstrate cropping systems to maximize limited water and provide factual bases for evolving water use strategies and policies. From 1991 to 1996 he was research coordinator for the Multiple Cropping Systems/Limited Irrigation and Water Quality research at that extension center. Schneekloth earned BS and MS degrees in mechanized agriculture in 1988 and 1991.

**Susan Seacrest** is president, The Groundwater Foundation, Lincoln. She founded the organization as the Nebraska Groundwater Foundation in 1985 and has served as its
president since then. During that time Seacrest has directed its growth and development into an internationally known organization. The Nebraska Groundwater Foundation became the Groundwater Foundation in 1993. The foundation's annual "Children's Groundwater Festival" was a first of its kind in the United States and has become an international model for hands-on environmental education for youth. The festival directly serves thousands of children every year, as well as countless more through its related educational outreach programs. Seacrest founded and chairs the National Groundwater Education Consortium, which sponsors an annual networking retreat. She was named one of 100 "Real Heroes" by Maxwell House Coffee Co. and USA Today. Seacrest received a BA from Saint Olaf College, MN and an MS Ed from the University of Rochester, NY.

Richard C. Stockdale administers the groundwater division of the Wyoming State Engineer's Office. The division issues water rights, investigates water rights disputes and has oversight for legislative issues dealing with groundwater resources. Stockdale has a BS in geology from Fort Hays State University, Hays, KS and an MS in geology from the University of South Dakota-Vermillion.

Lori L. Triplett is president and chairs the board of the Great Plains Foundation in Overland Park, KS. She earned a BA with honors from the University of Arkansas in 1981, an MA from the University of Missouri-Kansas City in 1988 and a JD from the UMKC School of Law in 1995, where she was awarded the "UMKC Outstanding Woman Law Graduate." Triplett is a licensed attorney in Missouri and is the originator and founder of the Great Plains Foundation and its programs. The foundation seeks to raise awareness, appreciation and knowledge of the Great Plains ecosystem through education, conservation and the exchange of ideas and information.

Everett Vogel is president of Stuart Fertilizer and Grain Inc., Stuart. Vogel has served as president of the Nebraska Fertilizer and Ag Chemical Institute, Inc. for two terms and remains on that board. He was a graduate of the Nebraska LEAD program, participating with Group No. 7. Vogel lives in Holt County.

Bob Volk directs the Water Center/Environmental Programs at UNL. He received his BS and MS degrees in agronomy from Ohio State University and his PhD from Michigan State University's Soil and Crop Science Department. He became director of the Water Center/Environmental Programs unit at UNL in 1990 and is secretary/treasurer of the Nebraska Water Conference Council. He served as department chair of the Agronomy Department at the University of Missouri from 1984-1989 and then took a sabbatical from 1989-1990 with Cooperative State Research Service/USDA focusing efforts on water quality programs, department reviews and water policy. From 1973-1984 Volk was assistant and associate professor in the Soil Science Department at the University of Florida-Gainesville. From 1970-1973 he was an assistant professor at the Research and Education Center at Belle Glade, FL. Volk was recently honored as "Water Guardian" for his continuing water stewardship work by the Nebraska Fertilizer and Ag-Chemical Institute.

Linda Weiss is district chief for the U.S. Geological Survey in Lincoln and has occupied a wide variety of positions with the USGS since 1983, including project chief, reports specialist and program officer. From 1987-1989 Weiss worked for the dredging division headquarters of the U.S. Army Corps of Engineers, Washington, D.C. Prior to her work for the U.S. government, Weiss worked in an environmental engineering consulting firm and for a municipal public works department, both in North Carolina. She earned a BS in civil engineering from Worcester Polytechnic Institute, Worcester, MA and an MS in civil engineering-hydrosystems from Virginia Polytechnic Institute and State University.
Blacksburg, VA. She has completed coursework towards a PhD in civil engineering-hydrosystems at the University of Illinois at Champaign-Urbana.

Roger Welsch spent most of his life teaching at universities and colleges in Nebraska, but nearly 10 years ago he walked away from that life in favor of living and writing from his small tree farm near Dannebrog. Today he is perhaps best known nationally for his essays on rural and small town living in Nebraska and on the Great Plains on CBS's "Sunday Morning" with Charles Kuralt. Welsch is a prolific writer, having authored more than 20 books. His fiction and folk humor have appeared across the country in publications ranging from Successful Farming to Readers Digest and Esquire. Along the way Welsch has received a wide range of awards and honors, but none more important than his adoption into the Omaha tribe in 1967 and his official designation as a tribal friend by the Pawnee in 1995.

Don A. Wilhite directs the National Drought Mitigation Center and is professor of agricultural climatology in the Department of Agricultural Meteorology at UNL. Wilhite specializes in studies of the impact of climate on society and societal responses to climatic events, particularly drought. He has edited and coedited several books on the subject and authored a guidebook on drought preparedness for developing countries under sponsorship of the U.N. Environment Program. Wilhite has authored or co-authored more than 70 journal articles, monographs, book chapters and technical reports in the last 10 years and is past chair of the American Meteorological Society's committee on applied climatology.

Dayle Williamson is Director, Nebraska Natural Resources Commission, Lincoln. Williamson has been associated with the NRC for nearly 40 years (since 1958) and has served as the agency's director since 1970. He is a founding member and past chair of the Nebraska Water Conference Council, which he was asked to serve on as one of 25 key representatives of water and irrigation interests by former NU president D.B. "Woody" Varner.

Osei Yeboah is a PhD candidate and graduate assistant in UNL's department of Agricultural Economics. A native of Ghana, West Africa, Yeboah earned a BS in Agricultural Economics from the University of Science and Technology, Jumasi, Ghana in 1987 and an MS in Agricultural Economics from North Carolina Agricultural and Technical University in 1993. From 1988 to 1991 he was an assistant agricultural economist with the Policy, Planning, Monitoring and Evaluation Department of the Ministry of Agriculture, Ghana.
Public and Private Responses to Great Plains Drought
by Francis Moul

This paper provides an historical perspective on Great Plains drought since human occupation, and how the various people here responded to it. The convergence of air masses on the Great Plains can cause droughts, and a brief list of such droughts is presented. Native people on the plains adapted to drought by various forms of farming to supplement bison hunting. They achieved major success in adapting a tropical grass, maize, as a primary plains food.

The end of the Civil War brought waves of white European settlers to the Great Plains. Their sod breaking, especially during the wet years, gave rise to unusual and generally wrong scientific theories on how the plow brought rain. John Wesley Powell attempted to make sense of settlement on the plains and western arid regions of America with an 1879 report. It presented a plan to revamp land surveys, land policy, land tenure and farming methods in the West. This plan was never enacted into law, although in modern times many practices now echo his ideas.

Congress instead passed a number of land tenure actions which exacerbated the problem rather than helping achieve legitimate settlement of the plains. Early irrigation efforts failed for various reasons. The plains saw immense plowups of fragile lands, often by suitcase farmers, during and after World War I. Those years were followed by the Great Drought and Depression of the Thirties and the answering New Deal programs.

The latest efforts of dealing with drought on the Great Plains include environmental laws such as the Conservation Reserve Program and other elements of the 1985 Farm Bill, the development of Natural Resource Districts in Nebraska and the widespread use of center pivot irrigation. It seems unlikely that the "climate-free agriculture" promised by center pivot irrigation will last out the depletion of water resources such as the Ogallala Aquifer.

Public Management Responses
In Time of Drought 1977-1997
by Don Nelson and Dayle Williamson

This paper describes the evolution of the Nebraska public response system for drought management, with particular emphasis on the role of the governor as chief policy maker and chief executive officer.

It was March 1977, and skywatching was becoming very important across the Midlands. Moves were being made in Nebraska to prepare for another dry year. Farmers were looking at the possibility of planting alternate crops. Some communities were looking at the possibility of deepening their wells or adding new ones. There was concern for fish and wildlife.

Something was different about the impending drought of the late 70's than the extended drought of the 1930's. The solution suggested by many was to use groundwater to expand irrigation to "get us through." Keith Farrer, a representative in the Kansas legislature, saw "widespread irrigation as the beginning of the end." He reflected that government should have a greater role in managing both ground and surface water supplies to assure continuing availability.

So how did Nebraska face these opposing views? Both were considered a reality and many states set plans in motion to develop a meaningful drought response system. On
March 1, 1977, Nebraska Governor Jim Exon established a drought task force to begin looking at the drought and to provide information to the Carter White House. The course was set, the focus should be directed at major water uses.

From this initial task force, each succeeding Governor has built on the plan to strengthen the drought management system in the state. Governor Bob Kerrey did a great deal to "formalize" the system by developing a Drought Assessment and Response System.

**Possible Impacts of Global Warming On Hydrology of the Ogallala Aquifer Region**

by Norm Rosenberg, Daniel J. Epstein, Raghovan Srinivasan, Robert A. Brown and Lance Vail

The Pacific Northwest National Laboratory is preparing a comprehensive analysis of the possible causes and potential effects on the United States of climatic changes that may be induced by greenhouse warming. An integrated assessment tool, the Global Change Assessment Model (GCAM), is used for this purpose. We have chosen to use three general circulation modules (GCMs) for the above-mentioned analysis of the entire conterminous United States. Hydrologic responses due to climate change are modeled using the Hydrologic Unit Model for the United States (HUMUS), a GIS-based system developed at Texas A&M University. HUMUS, as we employ it in this analysis, calculates natural flows unaffected by structures, dams, diversions, etc. Therefore, the results can be validated only against current flows at the limited number of U.S. gauging stations whose watersheds remain essentially unmanaged. Such a comparison was made with agreement sufficiently good to warrant further application of the HUMUS approach.

HUMUS calculates groundwater recharge as the residual after all other processes are accounted for. For this reason, and because of the broad simplifications we have made for purposes of the current application, (i.e., each 8-digit basin characterized by a single land cover, single soil, etc.) this analysis provides no specific information on how recharge processes in the Ogallala Aquifer would be altered by climate change. Rather, our results should acquaint persons engaged in managing the aquifer with the kinds of climate and hydrologic changes that are possible by the middle of the next century as the result of greenhouse warming. Those who know the region well can judge, at least qualitatively, the consequences of such changes on the demand for water and its availability for natural or engineered recharge of the Ogallala Aquifer.

**Natural Responses of Shallow Lakes and Wetlands to Climatic/Environmental Change:**

Focus on the Nebraska Sandhills

by David C. Gosselin, Mohan Khisty, Donald C. Rundquist and F. Edwin Harvey

The current question is how will climate change effect shallow lakes and wetlands in the Nebraska Sandhills. The answer is, it depends on how the change in climate impacts the seasonal occurrence of precipitation and evaporation. According to regional climate modeling for scenarios where the concentrations of CO2 in the atmosphere are equivalent to twice that of current levels, temperatures are expected to be generally about 5°C higher throughout the year than current values.

Precipitation is also expected to be higher than current levels, but seasonally variable, ranging from 6 percent higher in the summer to 24 percent higher in the spring. If these predictions are correct, and based on our current understanding of the system, we
suggest that the lakes and wetland environments may not be substantially impacted by the
type of environment change currently being predicted.

A Successful Water Conservation Program
In A Semi-Arid Region of Nebraska
by Don Adelman and Allen Dutcher

Legislative Bill 577 passed by the Nebraska Unicameral during the mid-1970’s permits any of Nebraska’s 23 Natural Resources Districts (NRDs) to invoke Groundwater Control Areas whenever groundwater supplies are short. Since the late 1970’s, a full-scale control area has been implemented by the Upper Republican NRD (URNRD) in southwest Nebraska. Irrigators must not exceed 72.5 inches of mined groundwater during any 5 year period (URNRD, 1993) and wellheads are monitored to insure that pumping doesn’t exceed allocations.

The URNRD counties (Dundy, Chase and Perkins) are very dependent on groundwater for nonagricultural use, since reliable surface water supplies don’t exist. In Perkins County, the city of Grant had to replace some public water supply wells because of excessive groundwater mining by irrigators.

The objective of this research was to compute a ratio of metered pumping data to the CIR calculated from weather data. This ratio indicates whether irrigators are pumping more water than crops require. If the ratio is less than one, irrigators are efficiently using groundwater.

The average amount of water pumped was calculated for each year by crop type and irrigation practice. Because no data was available for 1986 and 1987, a computer program was employed to calculate pumping averages. A seasonal CIR value was determined for each year, crop type and irrigation practice. Finally, a pumping to CIR ratio was derived.

When the two irrigation methods are compared to each other, center pivot irrigation appears to have a tighter range between the highest and lowest values during the period. In addition, center pivot irrigation has a lower ratio than gravity irrigation in almost every year. Perkins County irrigators also have lower ratios when compared to Chase County irrigators.

Limited Irrigation Management Strategies

A limited irrigation demonstration project was initiated during the 1996 cropping season in southwest Nebraska. The predominant soil types at the three demonstration sites were: silt loam at Arapahoe, sandy loam at Elsie, and fine sand at Dickens.

The crop rotations are a corn-corn-soybean-winter wheat (Arapahoe), corn-soybean-dry edible bean (Elsie), and continuous corn (Dickens). Irrigation treatments for corn were current farmer management, best management practices for no water stress, late initiation of irrigation and preset water allocation.

Late initiation was intended to encourage root development beyond that of a full irrigated crop. Water allocations for corn were 10 inches at Arapahoe and Dickens, and 6 inches at Elsie. Allocations were 5 inches and 4 inches for dry edible beans and wheat, respectively.

Grain yields at Elsie and Dickens were similar for all treatments. Grain yields at Arapahoe were more when corn received less irrigation. Yields were reduced due to increased leaching of nitrates with more irrigation.
A Good Example for Aquifer Management
In the 21st Century?
by Amara Tandy Brook and Michael H. Glantz

For Texas High Plains residents, Ogallala Aquifer depletion has been an important and growing concern for almost half a century. Since 1951, the High Plains Underground Water Conservation District No. 1 has been working for efficient use of water through research, education, voluntary conservation guidelines and a few mandatory rules on water use.

Recently, many people in the High Plains region and elsewhere have been promoting more local control over natural resources. This water district serves as an excellent case study through which to examine the benefits and drawbacks of this approach. Is it a good example for aquifer management in the 21st century? Has the district successfully addressed the goals and values of the stakeholders in the management of the region's Ogallala Aquifer water?

These questions are addressed through 1) historical research on changes in natural resources and other aspects of the region served by the district, 2) direct open-ended interviews with district, state and federal officials and farmers, and 3) a public opinion survey of area residents.

The Texas High Plains Ogallala Area Water Management Plan
by Lee Arrington, C.E. Williams and John B. Ashworth

In Texas, the High Plains is the most extensive region irrigated with groundwater and has historically experienced the greatest reductions in saturated thickness in the entire eight-state extent of the aquifer. In 1994, local water-related entities joined forces to address the problem of a diminishing resource. A process was begun to develop a regional water management plan that would examine alternatives for better, more efficient water use.

The plan will take both near and long-term (years 1990 to 2050) perspectives, address the entirety of the defined Texas High Plains region, and specify various policy and implementation initiatives needed to support an improved water management future.

The plan will be broken down into six main tasks: 1) water demands, 2) water supplies, 3) supply allocation studies, 4) institutional analyses, water policy and implementation recommendations, 5) special studies, and 6) management and coordination.

Optimal Local Conjunctive Water Management
In The Frenchman Creek Basin of The Republican River
by Osei A. Yeboah, Maurice Baker and Glenn A. Helmers

An analysis of the Frenchman Creek Basin of Nebraska was completed examining the impact of reduced stream flows on economic returns generated in the area. The impact of several variables (irrigation wells, precipitation, etc.) on stream flow changes was analyzed.

Regardless of cause, stream flow declines result in less total water available for irrigation. The economic impact of reduced irrigation water (both surface and groundwater) was analyzed using a dynamic programming model of producer adjustment. Reduced water...
Nebraska's Natural Resources Districts (NRDs): Celebrating 25 Years

Nebraska's unique Natural Resources Districts, or NRDs, were created in 1972 under legislation introduced in 1969 by the late State Senator Maurice Kremer. Now celebrating their silver anniversary, the NRDs were created to develop and execute plans, facilities, works and programs in the following areas:

- Erosion prevention and control.
- Floodwater and sediment damage prevention.
- Water supply for any beneficial uses.
- Development and management of fish and wildlife habitat.
- Development and management of park and recreational facilities.
- Development, management, use and conservation of surface water and groundwater.
- Flood prevention and control.
- Soil conservation.
- Drainage and channel improvement.
- Forestry and range management.
- Pollution control.
- Solid waste disposal and sanitary drainage.

Nebraska's 23 NRDs and their general managers are:

- Lower Loup NRD, Richard Beran, Ord
- Central Platte NRD, Ron Bishop, Grand Island
- Upper Loup NRD, Will Boyer, Thedford
- North Platte NRD, Ronald Cacek, Gering
- Lower Big Blue NRD, L. Ronald Fleecs, Beatrice
- Middle Republican NRD, Wayne Heathers, Curtis
- Middle Niobrara NRD, Robert Hilske, Valentine
- South Platte NRD, Rod Horn, Sidney
- Lower Platte South NRD, Glenn Johnson, Lincoln
- Twin Platte NRD, Ken Miller, North Platte
- Upper Republican NRD, Ron Milner, Imperial
- Lower Platte NRD, John Miyoshi, Wahoo
- Lewis & Clark NRD, Tom Moser, Hartington
- Lower Niobrara NRD, James Neneman, Butte
- Papio-Missouri River NRD, Steve Oltmans, Omaha
- Little Blue NRD, Mike Onnen, Davenport
- Nemaha NRD, Paul Rohrbaugh, Tecumseh
- Upper Elkhorn NRD, Dennis Schueth, O'Neill
- Lower Elkhorn NRD, Stan Staab, Norfolk
- Tri-Basin NRD, John Thorburn, Holdrege
- Upper Niobrara-White NRD, Les Tlustos, Chadron
- Upper Big Blue NRD, John Turnbull, York
- Lower Republican NRD, Ronald Wunibald, Alma
Accessing Water Information on the World Wide Web

Those looking for information on the Ogallala Aquifer, or on the subjects of water, drought, climate or the environment may want to search the nearly unlimited resources of the World Wide Web (WWW). The following is a listing of "Home pages," or URLs, that may help you begin a search for more specific information, or web sites. Please note, however, that home page URLs can frequently change.

(Listed web sites are from "How To Access Water Resources Information," a publication of the Water Center/Environmental Programs at the University of Nebraska-Lincoln. Copies may be obtained by phoning (402) 472-3305 or via e-mail at stress@unlinfo.unl.edu.

Nebraska Online
National economic, social and environmental data bank, catalog of state and federal documents, GIS data inventory, state government databases
http://www.nol.org
Call 1-800-307-2665 for information.

American Water Resources Association
Information on conferences, publications and message box for suggestions
http://www.uwin.siu.edu/awra

American Water Works Association
http://www.awwa.org/

California Department of Water Resources
General information, programs, water conditions, state water projects
http://www.dwr.water.ca.gov/

Clean Water/Wetlands (National Wildlife Federation)
http://www.igc.apc.org/nwf/pol/actionpg/issues.html#cwa

Conservation and Survey Division, University of Nebraska-Lincoln
http://nesen.unl.edu/csd/index.html

Federal Web Locator Service
A one-stop jumping off place to federal web sites.
http://www.law.vill.edu/fed-agency/fedwebloc.html

The Groundwater Foundation
http://www.groundwater.org

Groundwater Protection Council
http://gwpc.site.net/

Institute of Agriculture and Natural Resources, University of Nebraska-Lincoln
http://ianrwww.unl.edu
Missouri River Division, Water Management Information
U.S. Army Corps of Engineers, Civil Works
Information on current river conditions, water management, current reservoir conditions and bulletins.
http://www.mrd-wc.usace.army.mil/mrdedl-r.html

National Institutes for Water Resources Research
Web sites for U.S. water resources research institutes.
http://wrri.eng.clemson.edu

National Water Conditions by USGS
Groundwater tables, aquifer tables, stream water extreme table, surface water charts and streamflow maps.

Natural Resources Conservation Service
http://www.ncg.nrcs.usda.gov/

University of Nebraska-Lincoln
http://www.unl.edu

U.S. Bureau of Reclamation
Information on reclamation activities and upcoming events. Reclamation activities include environmental activities, international activities and Native American issues. Links to other offices.
http://www.usbr.gov/

U.S. Environmental Protection Agency (EPA)
http://ftp.epa.gov/

U.S. EPA Office of Water
Water quality conditions.
http://www.epa.gov/3056/suml.html/

U.S. Geological Survey
http://www.usgs.gov

U.S. Water News
http://www.mother.com/uswaternews/

Water Resources Research at the NU West Central Research and Extension Center, North Platte
http://ianrwww.unl.edu/ianr/wcrec/ground.htm

WaterWise. The Water Efficiency Clearinghouse
http://www.waterwiser.org/

Water Center/Environmental Programs, University of Nebraska-Lincoln
http://ianrwww.unl.edu/ianr/waterctr/wchome.html