Colorado
High Plains
Advisory Committee

Colorado
Department of
Agriculture

1525 Sherman Street
Denver, Colorado 80203
(303) 839-3218

High Plains Study

HIGH PLAINS - OGALLALA AQUIFER STUDY

A six-state $6 million study authorized by Congress is underway to develop water supply augmentation and water demand strategies for High Plains areas dependent upon the Ogallala Aquifer. Colorado, Nebraska, Kansas, Texas, Oklahoma and New Mexico are each conducting state-level research under the direction of the general contractor, the firm of Camp, Dresser & McKee. The general contractor's final report to Congress, including recommendations for action, is due June 30, 1982.

The Colorado portion of the study is being conducted jointly by four state agencies and Colorado State University. A Colorado High Plains Advisory Committee has been created to disseminate information about the project in Colorado and to review water supply and demand strategies that will be developed by the general contractor.

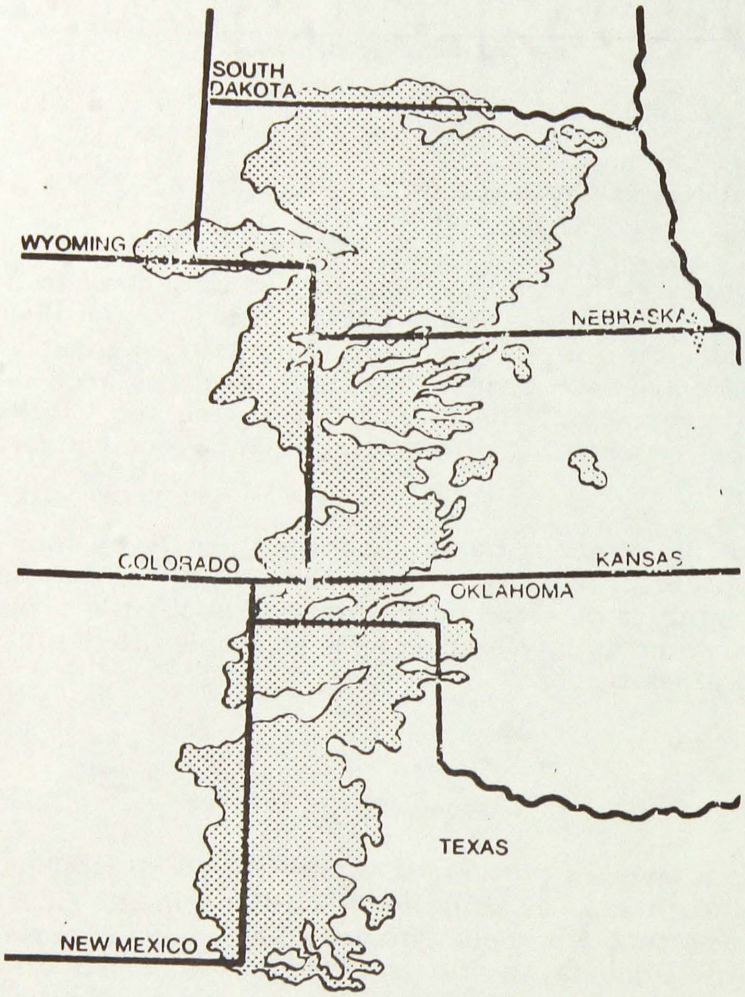
BACKGROUND

The Ogallala Aquifer is a layer of porous rock saturated with millions of acre-feet of water, lying beneath 225,000 square miles of land in the Great Plains. Unlike rivers and streams that are replenished annually from snowmelt and natural precipitation, the Ogallala Aquifer is essentially a closed system: it receives virtually no additional runoff. Over the past 30 years, the number of irrigated acres in the six-state lying over this region has increased from 2.6 million acres to 9.6 million acres. Because the rate of water withdrawal greatly exceeds the rate of recharge, groundwater levels are steadily dropping. Rapidly rising energy costs, coupled with declining groundwater levels, are creating a crisis situation for agricultural producers and High Plains communities.

A rapid decline in irrigation, unless offset by other activity, will have serious economic and social consequences for the High Plains area and for the entire six-state region. Eliminating irrigation from the Ogallala Aquifer in Colorado alone would reduce the state's irrigated acreage by 18 percent and could cause a decrease of as much as $500 million annually to the state's economy. The economic loss to the entire six-state region would be in the billions of dollars.

REGION

The Ogallala Formation (shaded below) forms the principal aquifers supporting irrigation in the High Plains of Colorado, Kansas, Nebraska, New Mexico, Oklahoma, South Dakota, Texas and Wyoming.



STUDY AUTHORIZATION AND PURPOSE

In response to this issue, Congress enacted legislation in 1976 for a comprehensive study. This legislation (P.L. 94-587) states the fundamental purpose of the study:

> "Sec. 193. In order to assure an adequate supply of food to the nation and to promote the economic vitality of the High Plains region, the Secretary of Commerce . . . is authorized and directed to study the depletion of the natural resources of those regions presently utilizing the declining water resources of the Ogallala aquifer, and to develop plans, to increase water supplies in the area and to report thereon to the Congress . . . In formulating these plans, the Secretary is directed . . . to examine the feasibility of various alternatives to provide adequate water supplies to the area. . . . to assure the continued economic growth and vitality of the region . . ." (emphasis added)

ORGANIZATION AND SCOPE OF THE STUDY

The Economic Development Administration, a branch of the U.S. Department of Commerce, is administering the study with the assistance of a six-state High Plains Commission. Each of the six states has three members of the Commission. Colorado's representatives are: Morgan Smith, Commissioner, Colorado Department of Agriculture; Monte Pascoe, Executive Director, Colorado Department of Natural Resources; and Milton ("Bud") Mekelburg, Yuma Farmer, and Vice-President, National Association of Conservation Districts.

The study consists of five major elements, each requiring analysis at state and regional levels. In Colorado, these work elements are being conducted by the following agencies:

	WORK ELEMENT	COLORADO LEAD AGENCY
A-1	Farm-level agricultural analysis	Colorado State University
A-2	Energy analysis	Office of Energy Conservation
A-3a	Water analysis	Colorado Division of Water Resources
A-3b	Area economic analysis	Colorado State University
A-3b	Environmental and social analysis	Colorado Division of Planning

Colorado's workplan is being coordinated by the Colorado Department of Agriculture. The Department also provides the fiscal management and coordination between Colorado, the general contractor, and the other states.

The management organization of the six-state High Plains Study consists of the Water Resources Division of Camp, Dresser & McKee, Inc. (water analysis) in association with Black & Veatch (energy analysis) as joint venturer and Arthur D. Little, Inc. (agricultural and socioeconomic analysis) as subcontractor. These firms are responsible for coordinating research among the individual states and conducting the six-state regional analyses. In addition to these analyses, the U.S. Corps of Engineers is examing alternatives for importing water into the region, through the High Plains Study.

The U.S. Geological Survey is conducting a related study of the Ogallala Aquifer Region. This study is examining the groundwater flow system of the aquifer and how it will respond to various water management strategies. Information from this study will be utilized by the High Plains Study as it becomes available.

STUDY PRODUCTS AND STRATEGIES

The study will examine six alternative development strategies for the High Plains Region:

1. Water Demand Management. Encourage users, by providing incentives, to practice conservation through application of proven technology.

2. Water Demand Management. Apply all advanced agricultural and water management technology on a broad scale.

3. Local Water Supply Management. Augment water supplies at local level with techniques such as artificial recharge, weather modification, land management, snowpack management, and evaporation management.

4. Subregional Intrastate Importation Supply Management. Augment local water supplies with intrabasin transfers of water.

5. Regional Interstate Importation Supply Management. Augment local water supplies with major interbasin transfers of water.

6. Non-Agricultural Alternatives. Develop and use available water for purposes other than agricultural production.

These alternatives are not mutually exclusive. It is possible that a mix of alternatives may be found to be the best solution for a particular subregion or a combination of subregions.

State level research will be completed by the spring of 1981. The general contractor will then integrate the information from the six states and prepare a final report for Congress by June 30, 1982. In this final report, each of the supply and demand strategies, as well as a continuation of the present situation (no-action strategy), will be evaluated for their impact upon the economy, and the natural and social environment of the region. The benefits and costs of each strategy will be included in the report.

PROJECT FUNDING

The $6 million appropriated for the study is being spent as follows:

General Contractor and Subcontractors	$3,205,000
State-level research (6 states @ $300,000)	$1,800,000
U.S. Corps of Engineers	$ 795,000
Six-state High Plains Commission	$ 200,000

For further information:

High Plains Study
Resource Analysis Section
Colorado Department of Agriculture
1525 Sherman Street
Denver, CO 80203
Telephone: (303) 839-3218

SIX-STATE HIGH PLAINS STUDY COUNCIL REPRESENTATIVES FROM COLORADO

Morgan Smith, Commissioner
Colorado Department of Agriculture

Monte Pascoe, Executive Director
Colorado Department of Natural Resources

Bud Mekelburg
National Association of Conservation Districts
Yuma

COLORADO HIGH PLAINS ADVISORY COMMITTEE MEMBERS

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Doyle Neiman
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Holyoke

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Walsh

J. A. Spiers
Yuma

Fred Wurtsmith
Yuma

Senator Maynard Yost
Crook

PRELIMINARY RESEARCH RESULTS

This booklet contains a brief summary of some preliminary research results from the High Plains Study on the Colorado portion of the Ogallala Aquifer. It is not a report, but a collection of maps and tables on groundwater, agricultural production, and related topics under discussion at this conference. Interim reports will be issued later in 1981 that will discuss the assumptions and procedures used to generate these and other results. The maps and tables were prepared under the direction of Dr. Robert Young, Department of Economics, Colorado State University, and Dr. Robert Longenbaugh, Assistant State Engineer, Groundwater Section, Division of Water Resources.

To minimize the possibility of misinterpreting this information, the following points should be kept in mind:

1. This information is preliminary, and may be modified later. Furthermore, since the assumptions and procedures used to generate this information are not described in this packet, it would be inappropriate to cite this information for technical or legal purposes.

2. This information describes the baseline case only. By definition, a baseline establishes a basis for comparison. These results project groundwater and agricultural production conditions for the next 40 years, assuming no significant change in public policy on agricultural water use. Alternatives on water management and supply--and their effects upon groundwater, agricultural production, etc.--will be compared to the baseline in the next phase of research to be completed later this year.

3. The information is incomplete in several ways. First, the information is summarized here for the northern and southern portions of the Ogallala Aquifer in Colorado. Later reports will contain such information at the county and township level. Second, information is reported for only three different years: 1979, 2000, and 2020. Later reports will include the years 1985 and 1990 as well. Third, in addition to information on groundwater and agricultural production, the complete baseline analysis will also project population, employment, economic activity, and social and environmental conditions over the next 40 years.

Conference participants will be notified by mail when interim reports are available later in 1981. For further information, contact the Resource Analysis Section, Colorado Department of Agriculture, 1525 Sherman Street Room 406, Denver, Colorado 80203 (303) 866-3219.

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High Plains Study

HIGH PLAINS CONFERENCE AGENDA

7:30 - 8:30 a.m.	Coffee and registration
8:30 - 9:00 a.m.	Welcome: (Arena) David Foy, Washington County Farmer and County Commissioner Slide Presentation: The Ogallala Aquifer: A Story of People and Water
9:00 - 9:30 a.m.	Remarks: Richard D. Lamm, Governor, State of Colorado; Morgan Smith, Commissioner, Colorado Department of Agriculture
9:30 - 10:10 a.m.	Colorado Research: Assumptions and Procedures, Dr. Robert Young, Department of Economics, Colorado State University and Dr. Robert Longenbaugh, Deputy State Engineer, Colorado Division of Water Resources
10:10 - 10:25 a.m.	Coffee Break
10:25 - 11:25 a.m.	Colorado Research: Preliminary Results, Dr. Robert Young and Dr. Robert Longenbaugh
11:25 - 12:15 p.m.	Six-state Overview: Harvey Banks, Project Director, Camp Dresser & McKee, Austin, Texas
12:15 - 1:30 p.m.	Lunch
1:30 - 2:15 p.m.	Water Importation: (Arena) Ton Kincheloe, P.E., U. S. Army Corps of Engineers, Southwestern Division, Dallas, Texas
2:15 - 2:30 p.m.	Coffee Break
2:30 - 4:00 p.m.	Special Topics (choose one)

1. PRODUCTION AGRICULTURE: (Arena) Crop production with little or no water. Minimum tillage, alternate crops, and irrigation scheduling will be discussed.
   - Moderator: Doyle Neiman, Farmer, Sterling, CO
   - Panel members:

     Darryl Smika, Director, Great Plains Experiment Station, Akron, CO

     Dwayne Konrad, Irrigation Engineer, Rural Electric Administration, Burlington, CO

     Wayne Shawcroft, Soil Scientist, USDA-Science & Education Administration, Akron, CO

     Ed Langin, Extension Agent, Southeast Area Extension Service, Lamar, CO

(MORE)

Table C-1. Projected Resource Use, by Years. Northern Ogallala Region (Subareas 1-5).

	Time Period				
	1979	1985	1990	2000	2020
Total Energy Use for Irrigation (billion BTU)	4,171	4,159	4,077	3,900	2,344
Electricity Use for Irrigation (million KWH)	413	410	425	453	368
Natural Gas Use for Irrigation (1000 MCF)	2,907	2,903	2,766	2,478	1,143
Irrigation Pumps, Electric	2,763	2,640	2,631	2,642	2,156
Irrigation Pumps, Natural Gas	1,040	992	971	832	448
Total Number of Pumps	3,803	3,632	3,602	3,474	2,604
Farm Consumption of Diesel Fuel (1000 gal.)	10,852	10,638	10,593	10,495	9,434
Farm Consumption of Gasoline (1000 gal.)	2,170	2,060	2,043	2,021	1,730
Farm Consumption of NH_3 (tons)	66,491	72,480	78,069	86,251	83,389
Farm Consumption of Other Fertilizer (tons)	40,934	42,641	45,155	48,779	36,771
Irrigation Farm Labor (man-years)	1,166	1,082	1,062	1,023	689
Dryland Farm Labor (man-years)	952	963	967	979	1,022

Table C-2. Projected Resource Use by Year, Southern Ogallala Region (Subarea 6).

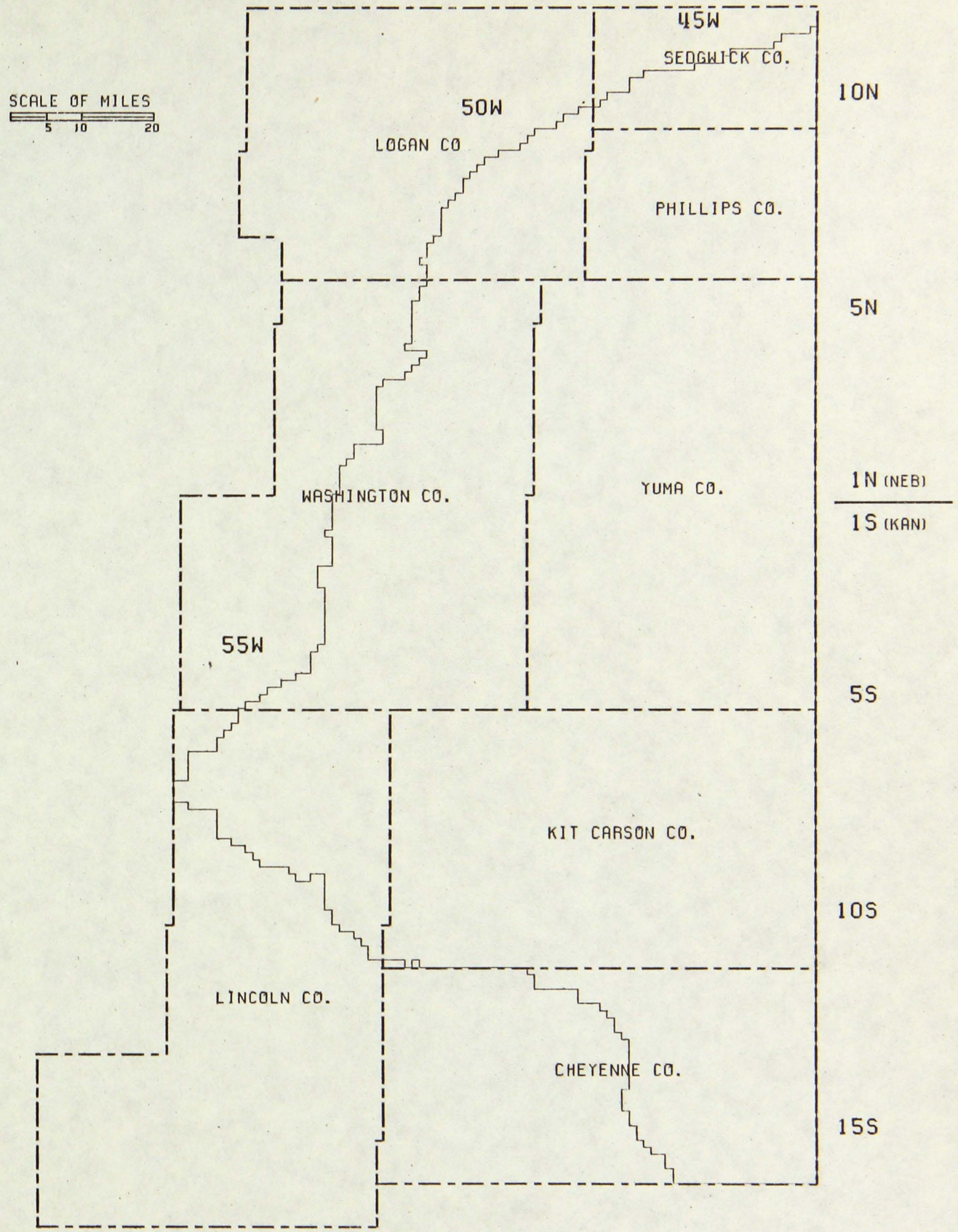
	Time Period				
	1979	1985	1990	2000	2020
Total Energy Use for Irrigation (billion BTU)	1,400	1,109	531	389	88
Electricity Use for Irrigation (million KWH)	28	22	22	22	21
Natural Gas Use for Irrigation (1000 MCF)	1,372	1,086	482	332	17
Irrigation Pumps, Electric	285	209	214	211	209
Irrigation Pumps, Natural Gas	679	614	495	246	17
Total Number of Pumps	964	823	709	457	226
Farm Consumption of Diesel Fuel (1000 gal.)	3,099	3,120	3,029	2,954	2,823
Farm Consumption of Gasoline (1000 gal.)	569	547	500	490	462
Farm Consumption of NH_3 (tons)	15,371	17,044	16,662	18,345	19,762
Farm Consumption of Other Fertilizer (tons)	5,570	3,805	2,845	2,247	1,548
Irrigation Farm Labor (man-years)	166	157	102	91	48
Dryland Farm Labor (man-years)	392	398	409	414	423

Table D-1. Projected Land and Water Use, Production, and Value of Production by Years, Northern Ogallala Region (Subareas 1-5).
Table C-2.

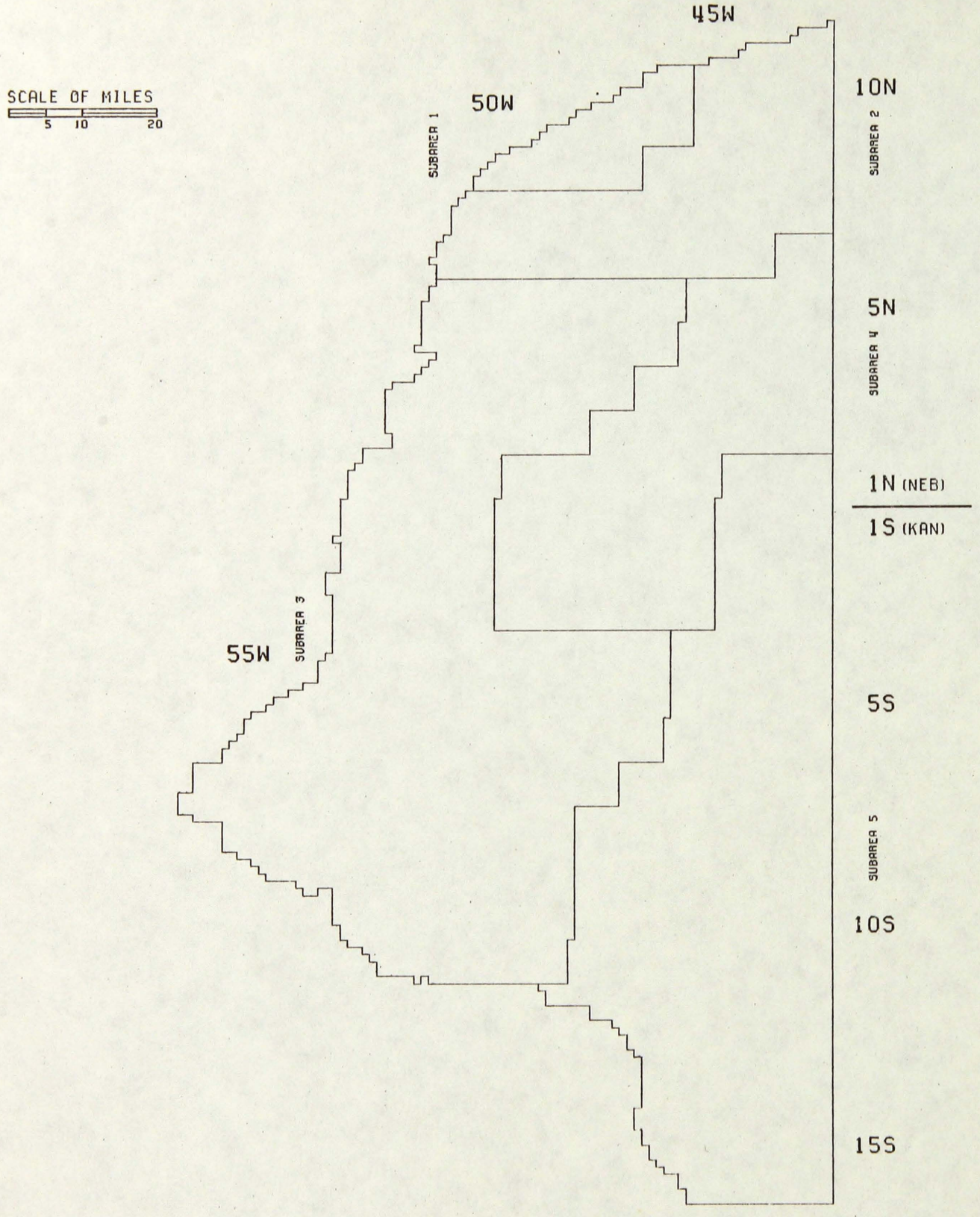
	Time Period				
	1979	1985	1990	2000	2020
Irrigated Cropland (1000 acres)	496	474	470	454	340
Dry Cropland (1000 acres)	1,194	1,212	1,217	1,231	1,286
Total Cropland (1000 acres)	1,690	1,686	1,687	1,685	1,626
Irrigation Water Pumped (1000 ac. ft.)	984	939	921	896	615
Crop Production					
Corn (mil. bu.)	53.9	58.3	62.1	67.4	48.1
Wheat (mil. bu.)	28.8	32.5	35.4	39.8	52.7
Sunflowers (1000 cwt.)	0	456.0	505.0	709.0	3,314.0
Pinto Beans (1000 cwt.)	367.0	343.0	327.0	181.0	34.0
Sugar Beets (1000 tons)	390.0	156.9	120.4	108.5	0
Alfalfa (1000 tons)	146.8	147.7	142.5	157.5	127.4
Value of Irrigated Crop Production (mil. of 1979 dollars)	167.7	200.3	213.1	240.6	198.2
Value of Dryland Crop Production (mil. of 1979 dollars)	104.1	112.9	124.3	144.7	189.7
Net Irrigated Crop Income (mil. of 1979 dollars)	47.0	56.6	48.7	64.5	64.3
Net Dryland Crop Income (mil. of 1979 dollars)	50.6	47.0	50.2	63.2	95.0

Table D-2. Projected Land and Water Use, Production, and Value of Production by Years, Southern Ogallala Region (Subarea 6).

	Time Period				
	1979	1985	1990	2000	2020
Irrigated Cropland (1000 acres)	103	88	59	47	24
Dry Cropland (1000 acres)	979	995	1,023	1,034	1,058
Total Cropland (1000 acres)	1,082	1,083	1,082	1,081	1,082
Irrigation Water Pumped (1000 ac. ft.)	164	137	84	69	41
Crop Production					
Corn (mil. bu.)	2.5	2.4	1.8	1.5	0.9
Sorghum (mil. bu.)	5.6	6.2	4.0	3.8	2.6
Wheat (mil. bu.)	8.1	6.5	7.7	9.3	11.8
Sunflowers (1000 cwt.)	0	916.0	1,233.0	1,542.0	1,681.0
Alfalfa (1000 tons)	32.5	26.2	36.2	16.1	10.2
Grass Hay (1000 tons)	0	0.6	17.1	1.7	0
Value of Irrigated Crop Production (mil. of 1979 dollars)	21.1	22.5	16.9	14.6	9.5
Value of Dryland Crop Production (mil. of 1979 dollars)	28.1	34.7	41.5	50.7	66.6
Net Irrigated Crop Income (mil. of 1979 dollars)	1.8	0.5	-0.7	0.8	2.3
Net Dryland Crop Income (mil. of 1979 dollars)	5.9	6.0	8.1	13.4	26.4



OGALLALLA AQUIFER, NORTH-EASTERN COLORADO



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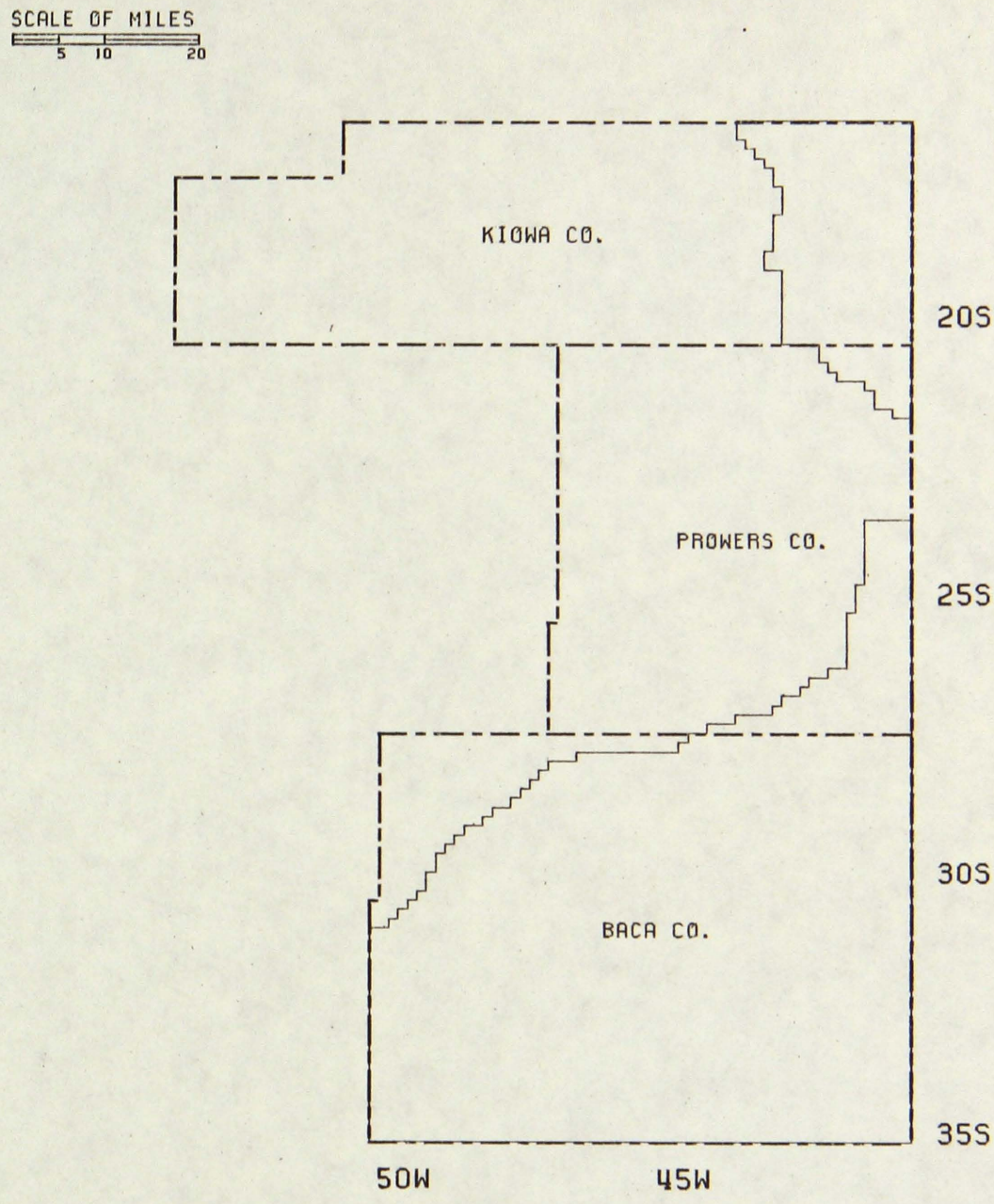
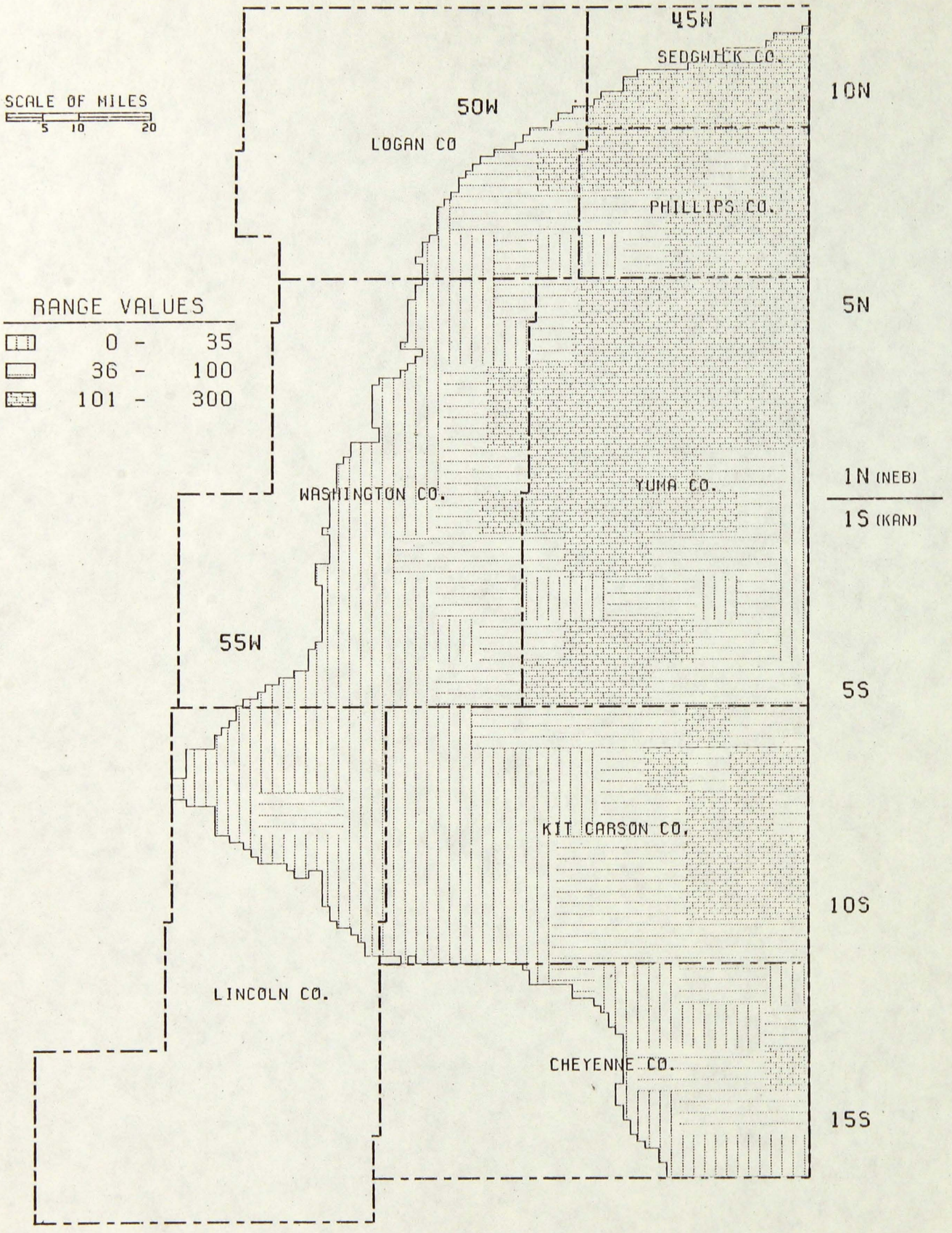
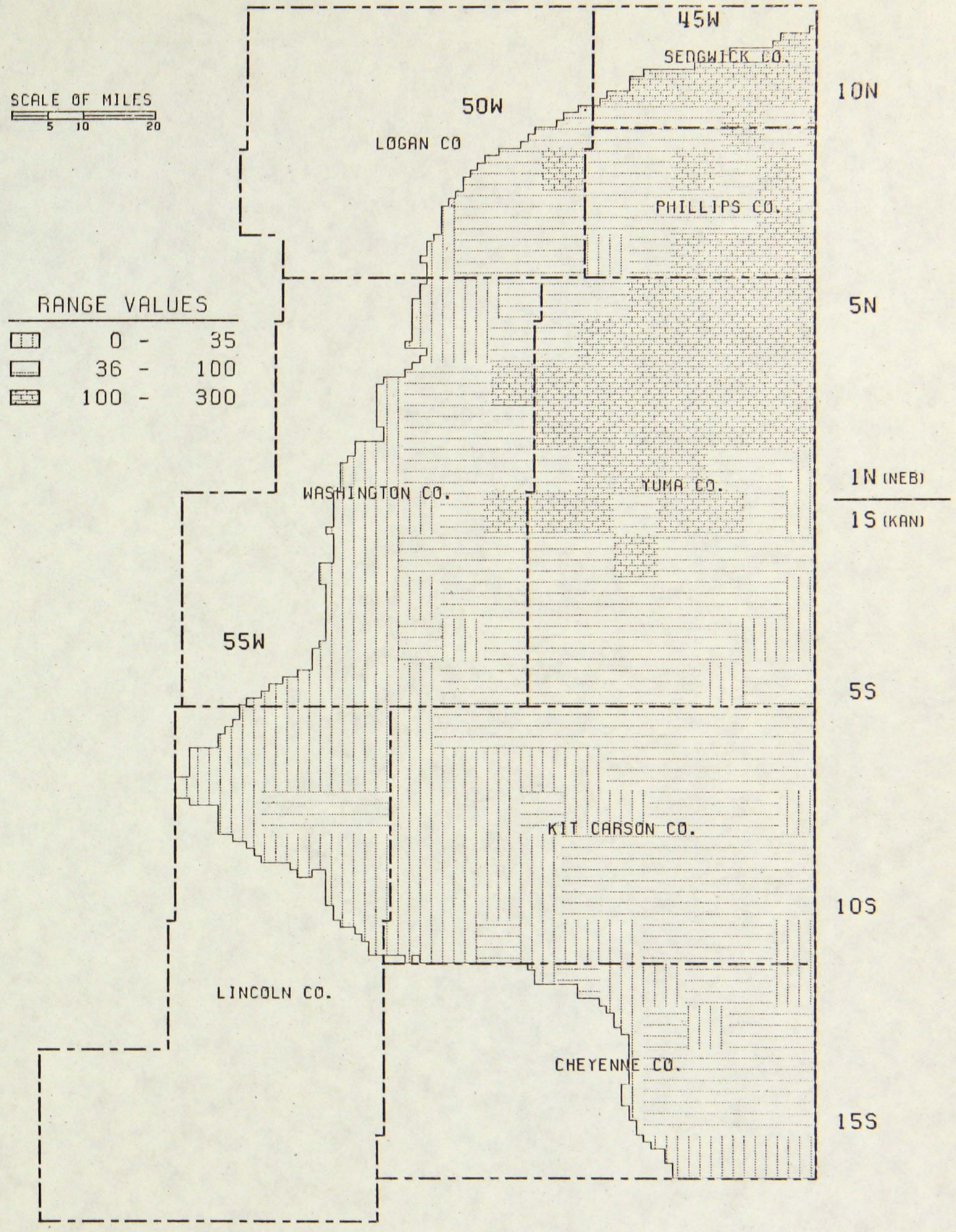


OGALLALLA AQUIFER, SOUTH-EASTERN COLORADO



OGALLALLA AQUIFER, NORTH-EASTERN COLORADO TOWNSHIPS BY 1979 SATURATION THICKNESS



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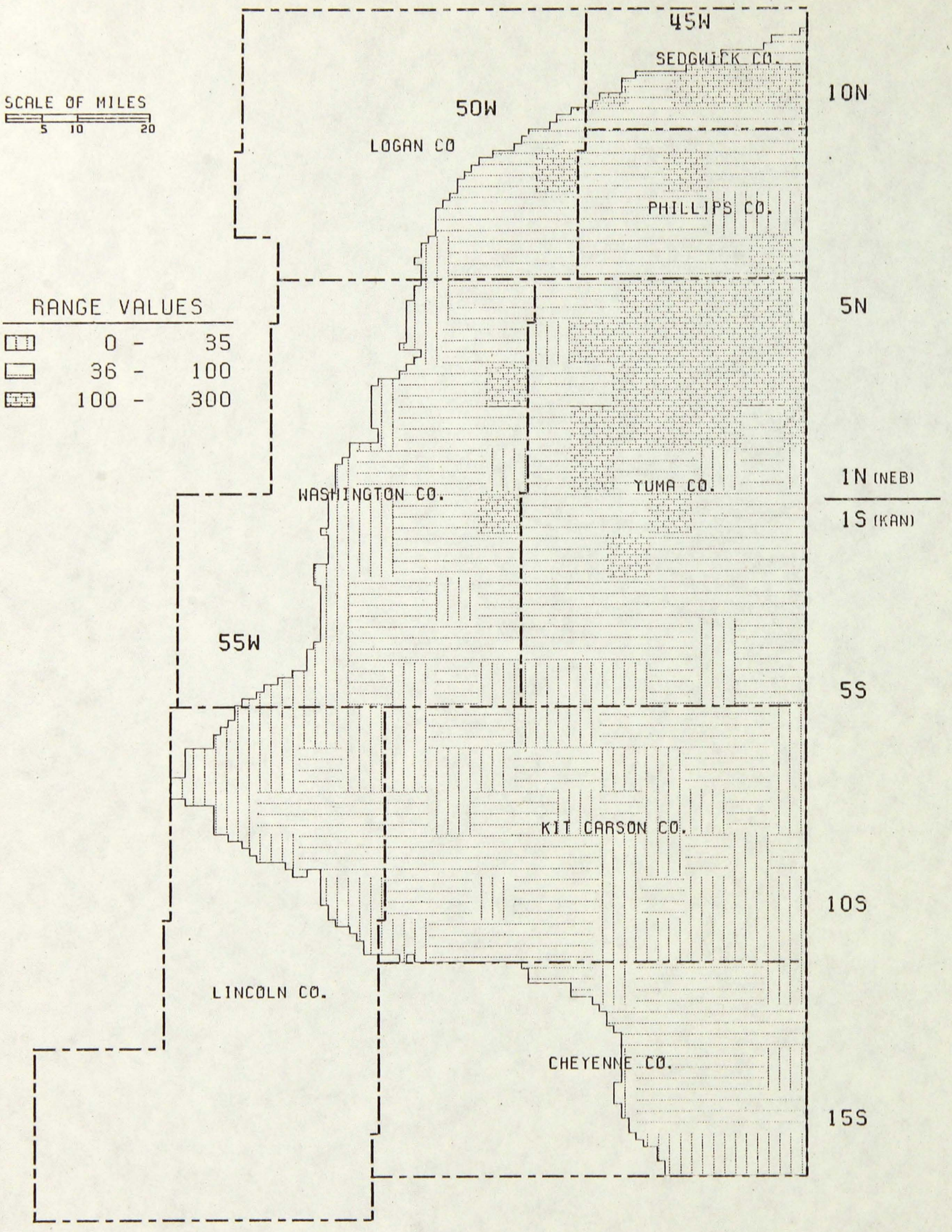
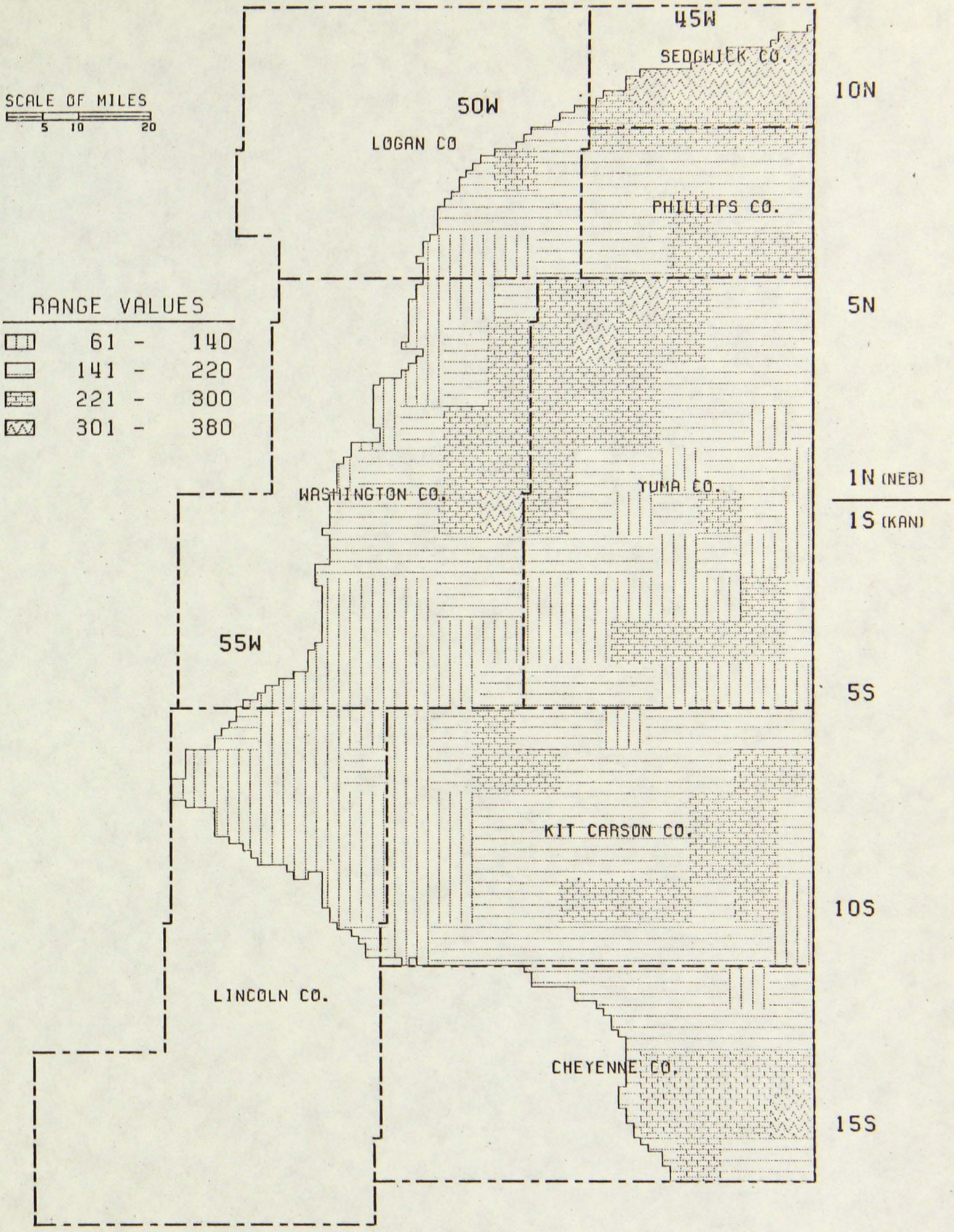
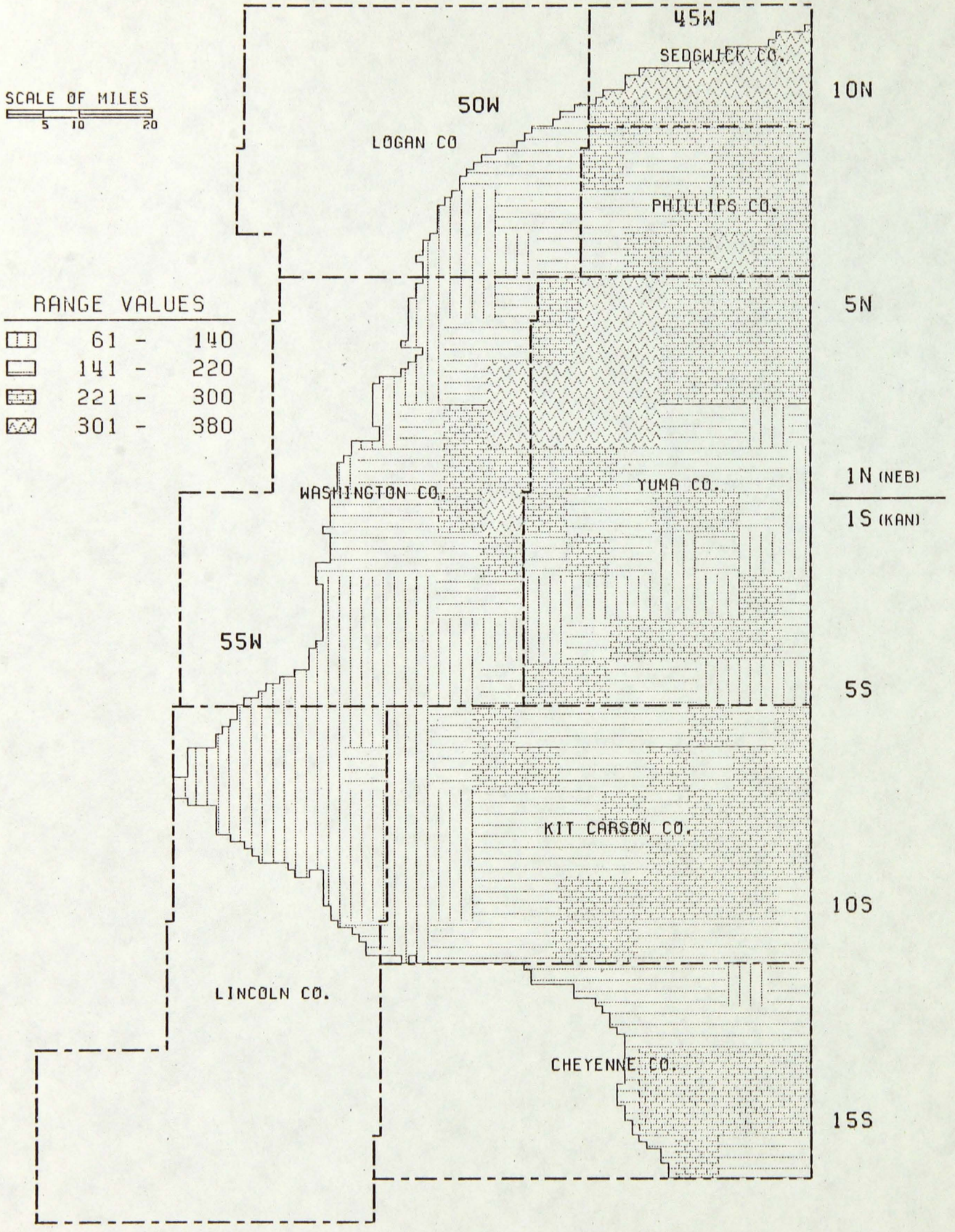


OGALLALLA AQUIFER, NORTH-EASTERN COLORADO TOWNSHIPS BY 2020 SATURATION THICKNESS



OGALLALLA AQUIFER, NORTH-EASTERN COLORADO
TOWNSHIPS BY 1979 DEPTH-ZONES

based on pumping depth - not static depth



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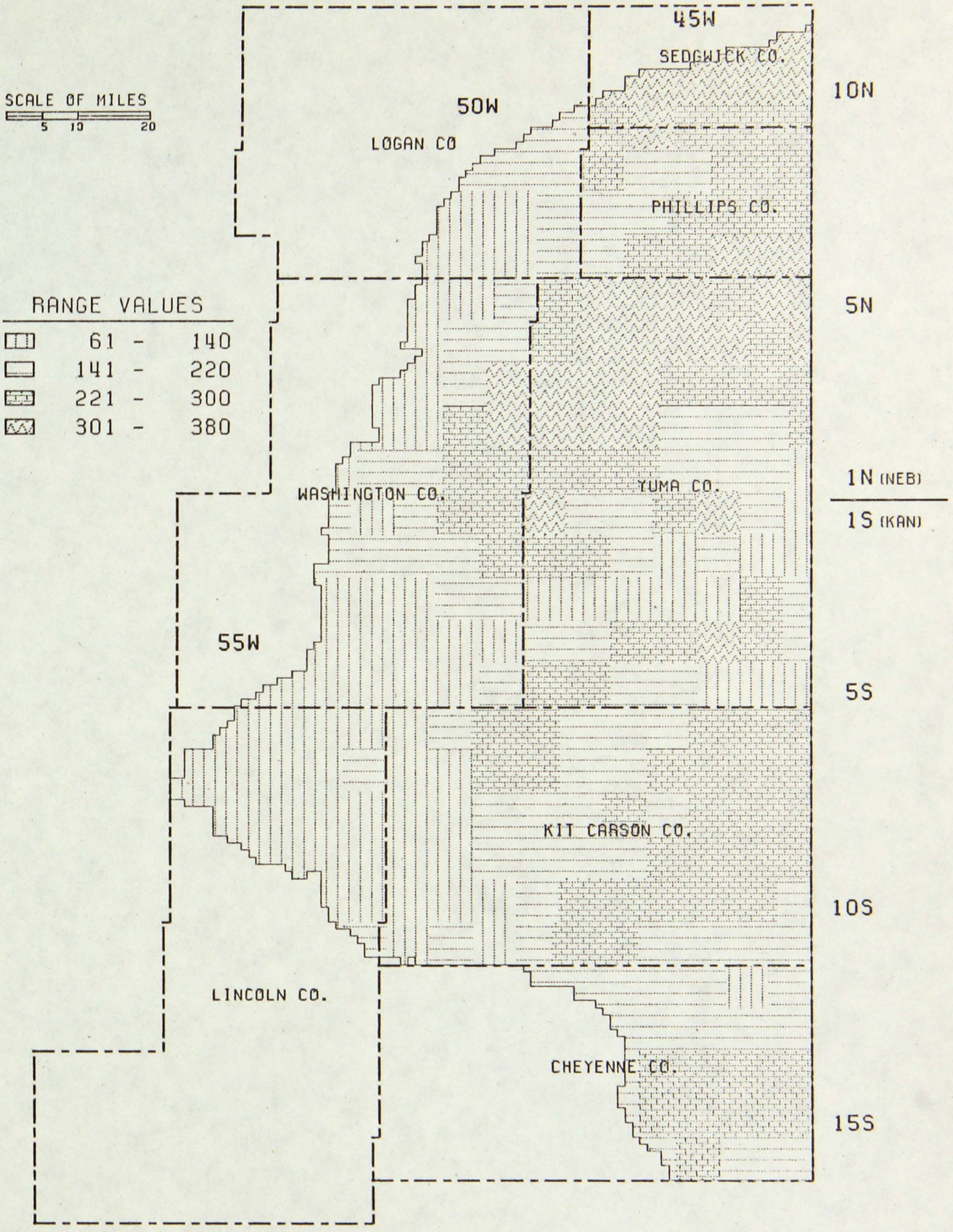
TOWNSHIPS BY 2000 DEPTH-ZONES



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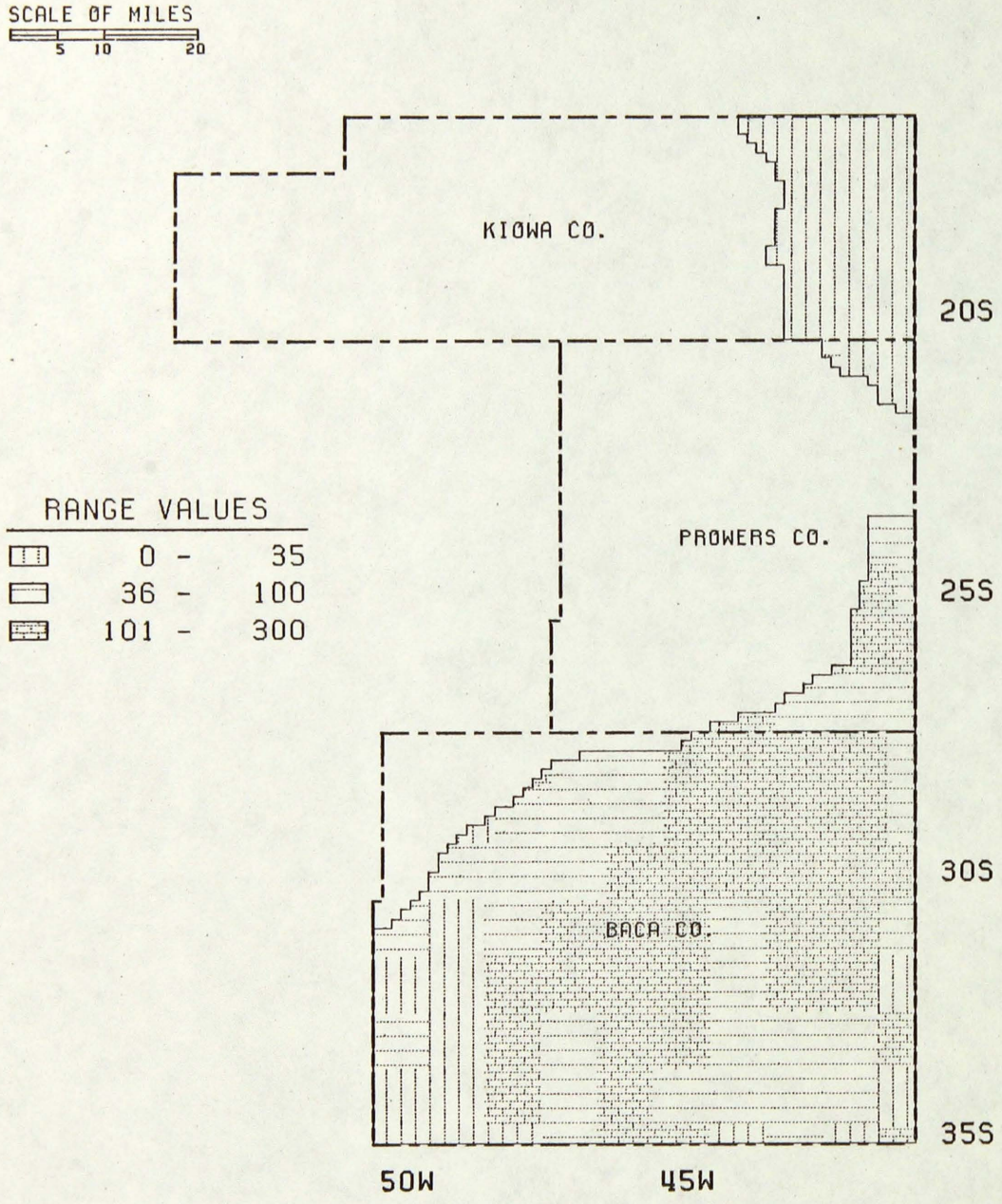
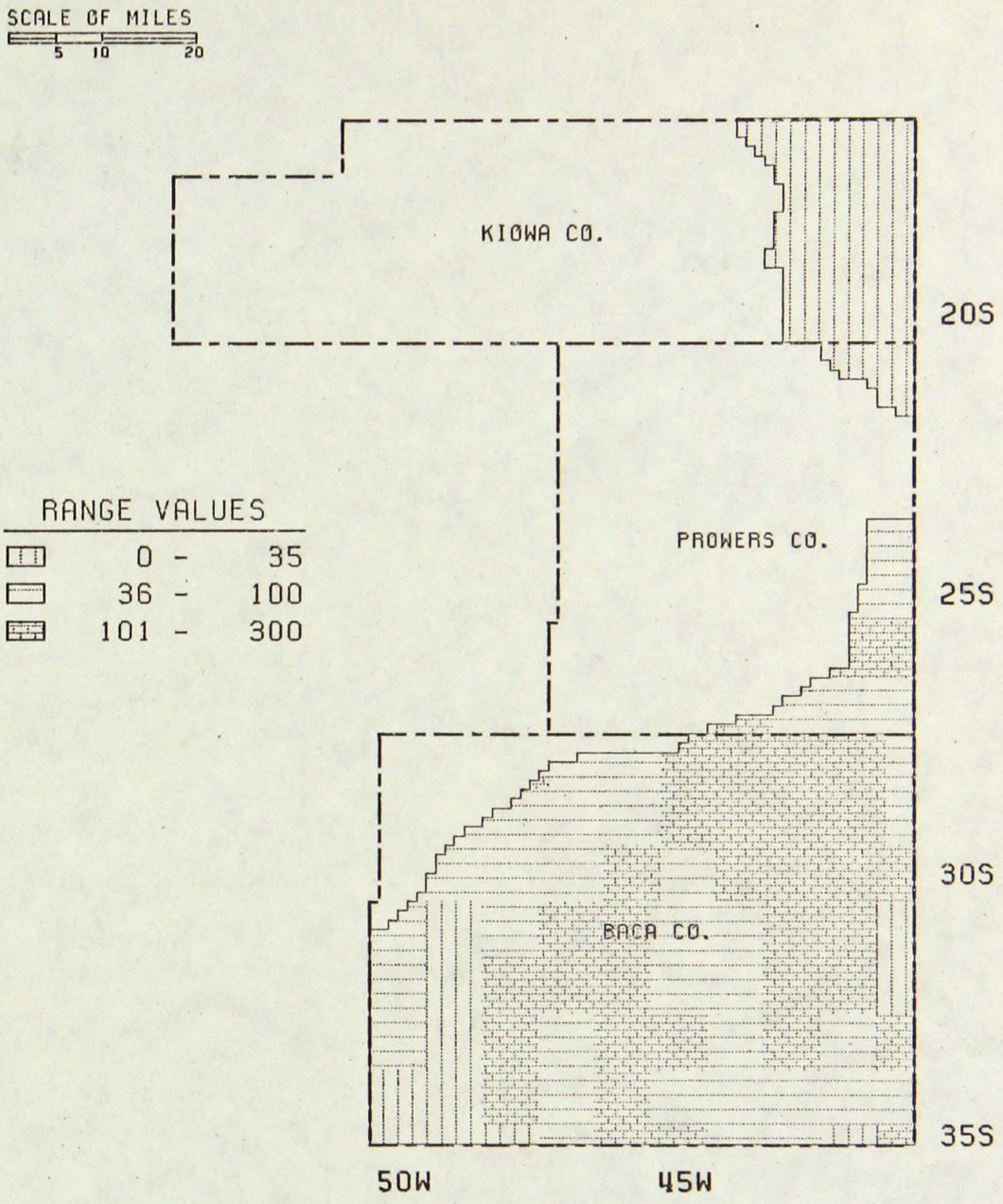
TOWNSHIPS BY 2020 DEPTH-ZONES



OGALLALLA AQUIFER, SOUTH-EASTERN COLORADO TOWNSHIPS BY 1979 SATURATION THICKNESS



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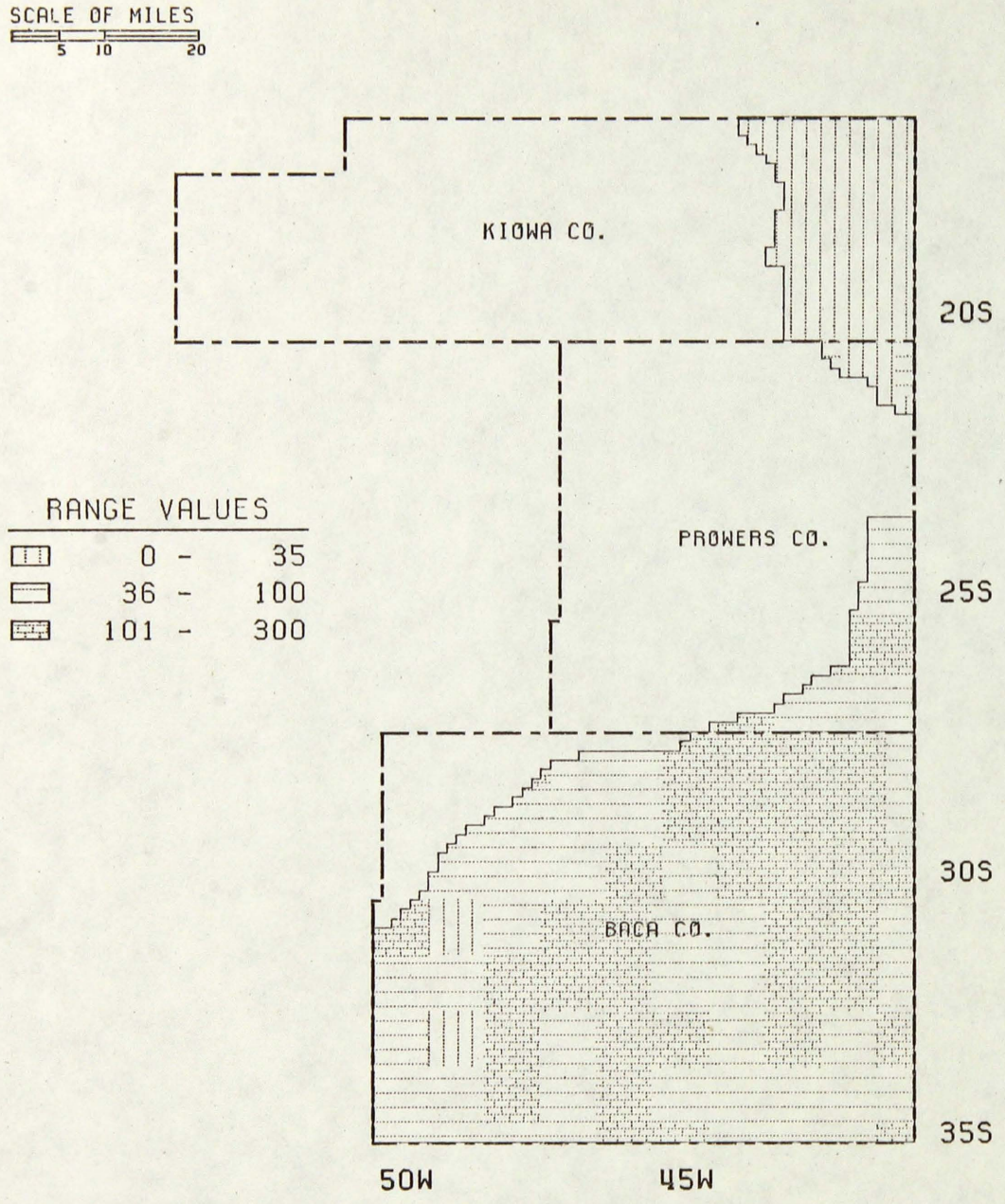

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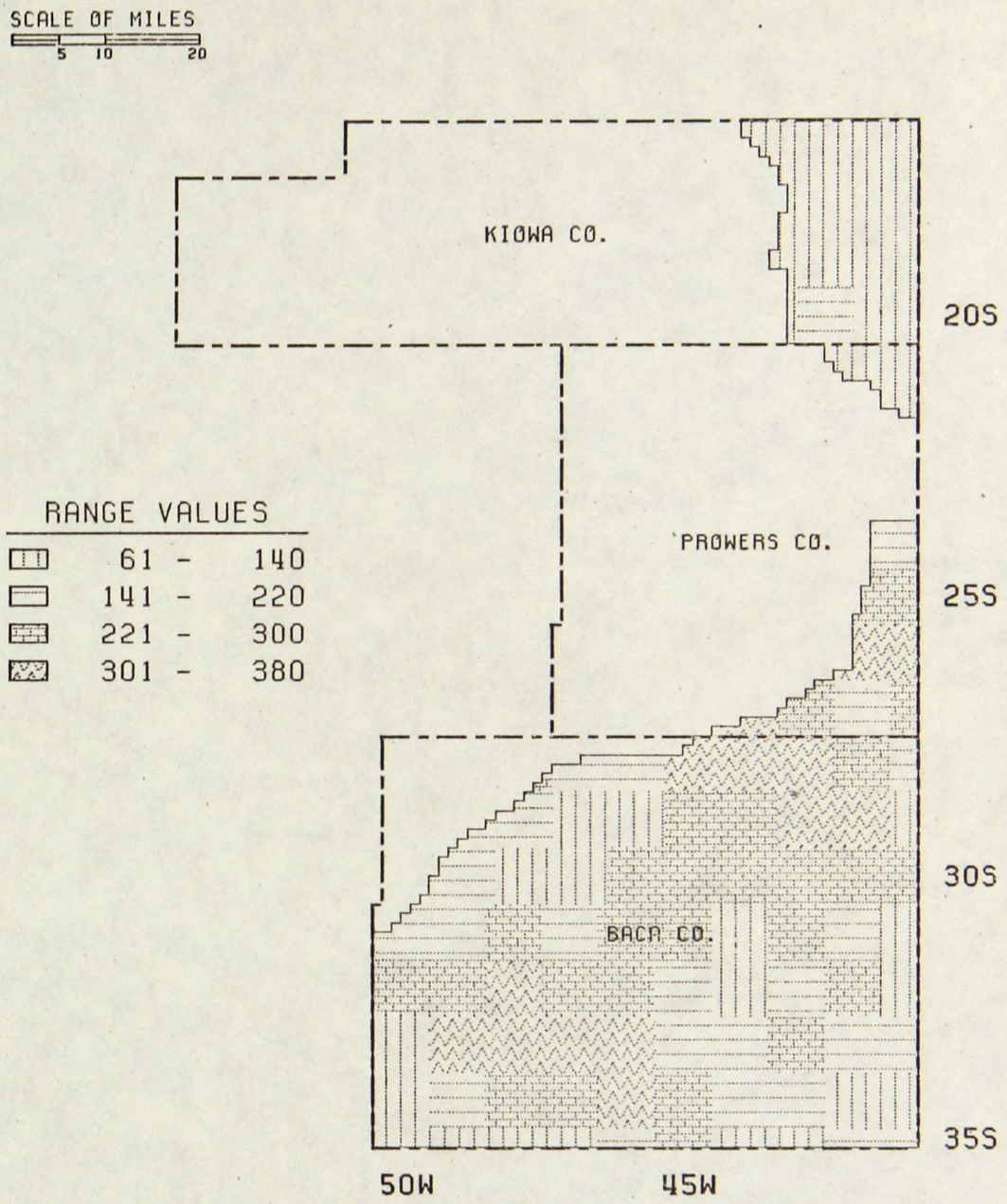
TOWNSHIPS BY 2020 SATURATION THICKNESS



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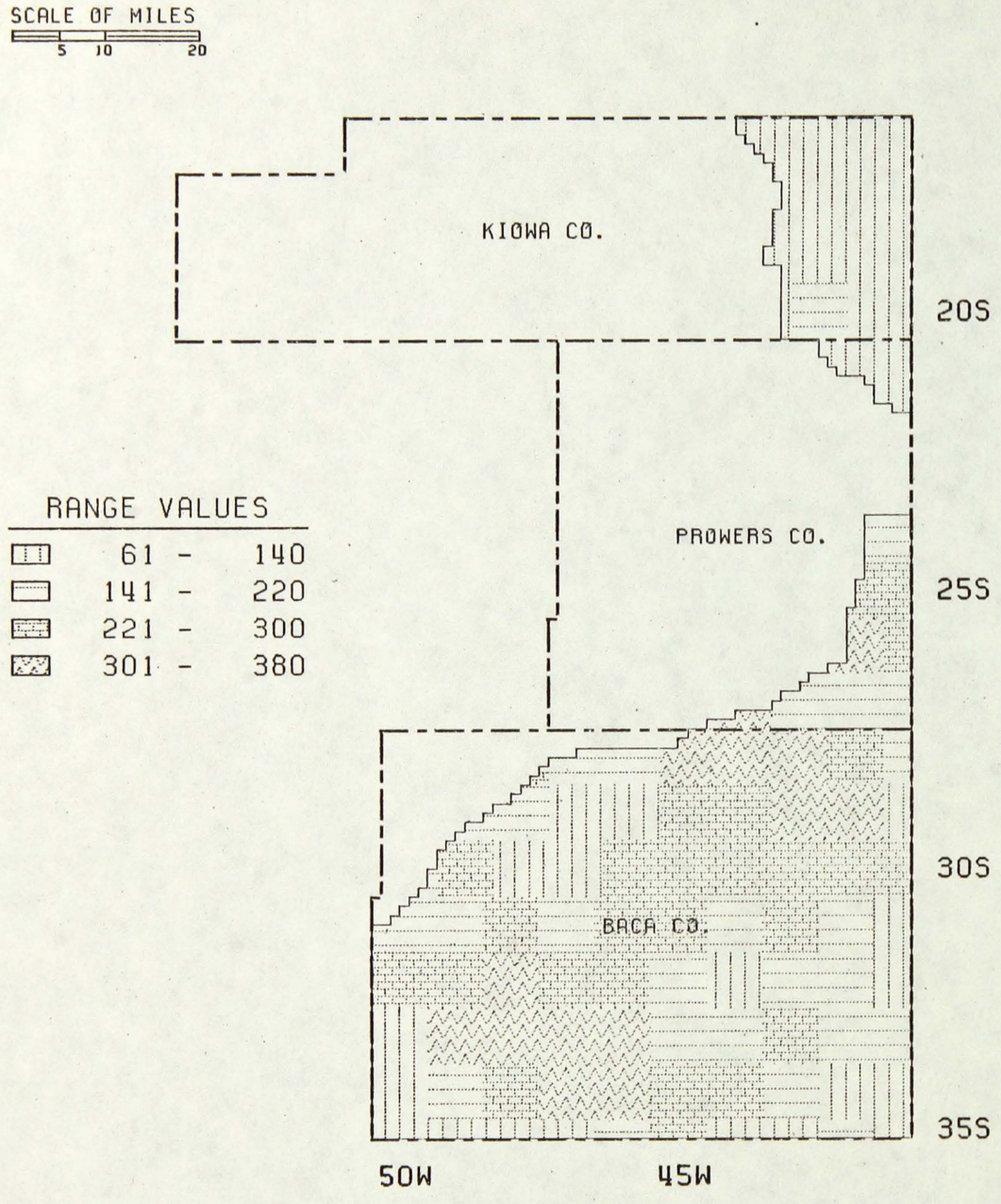
TOWNSHIPS BY 1979 DEPTH-ZONES



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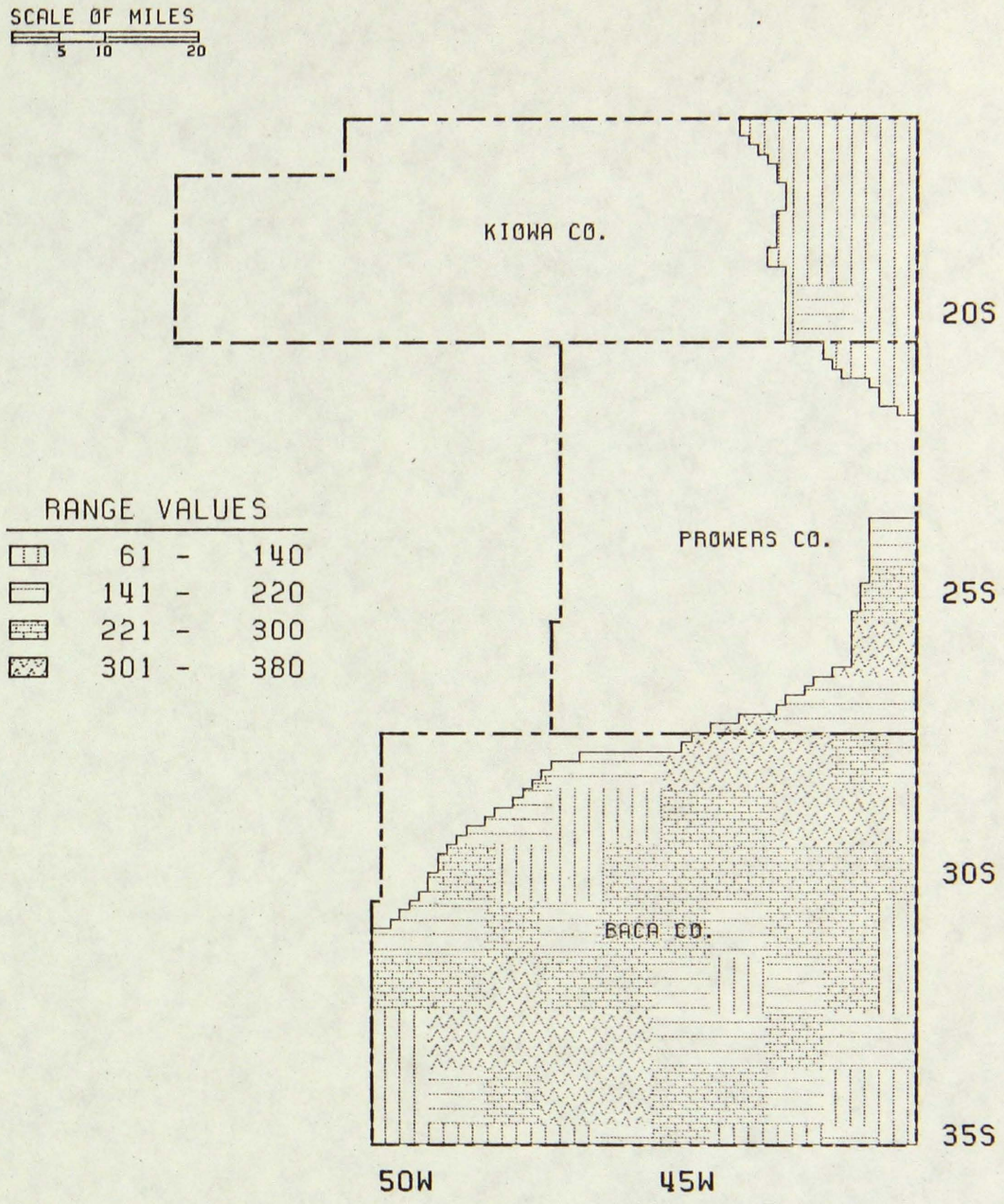
TOWNSHIPS BY 2000 DEPTH-ZONES



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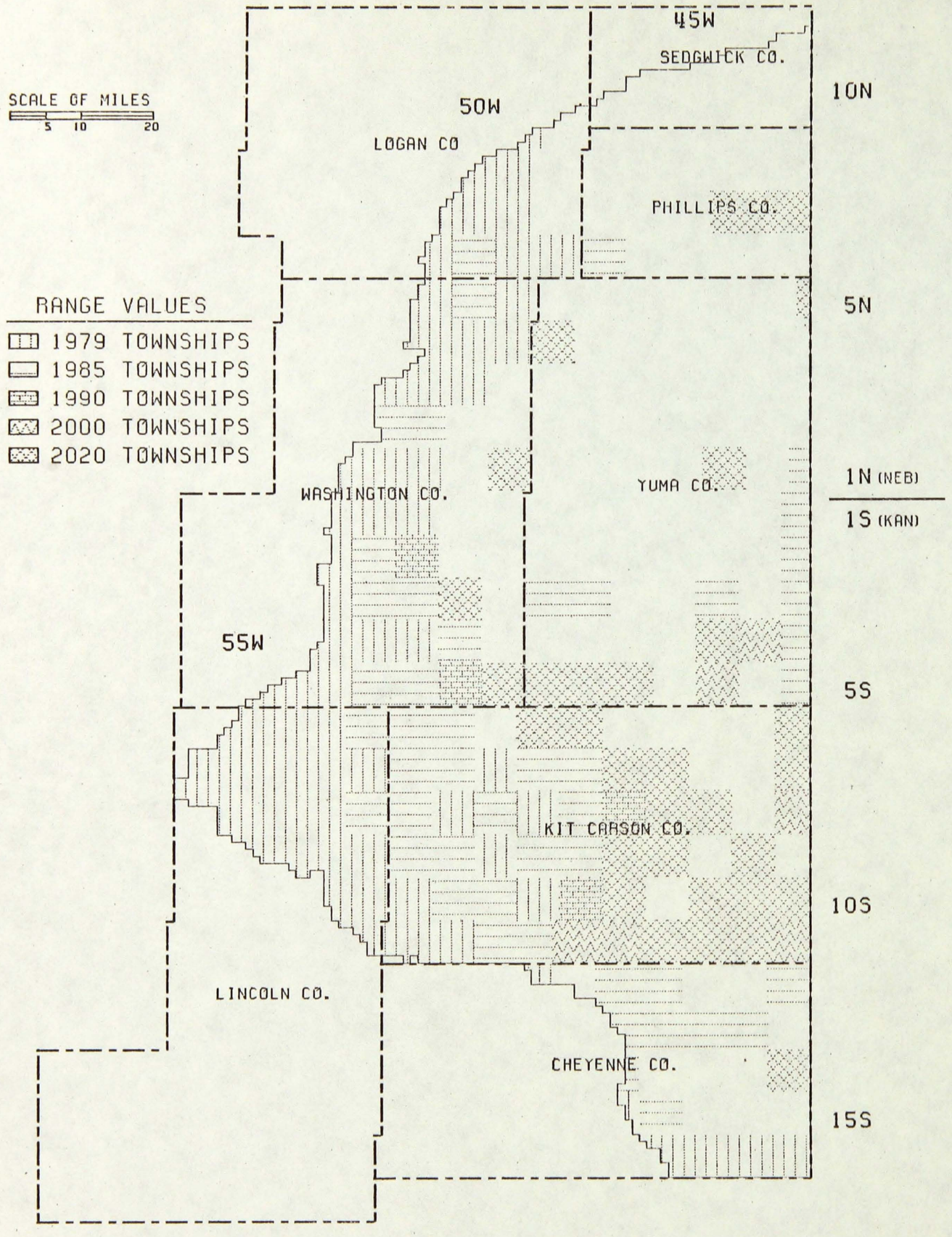
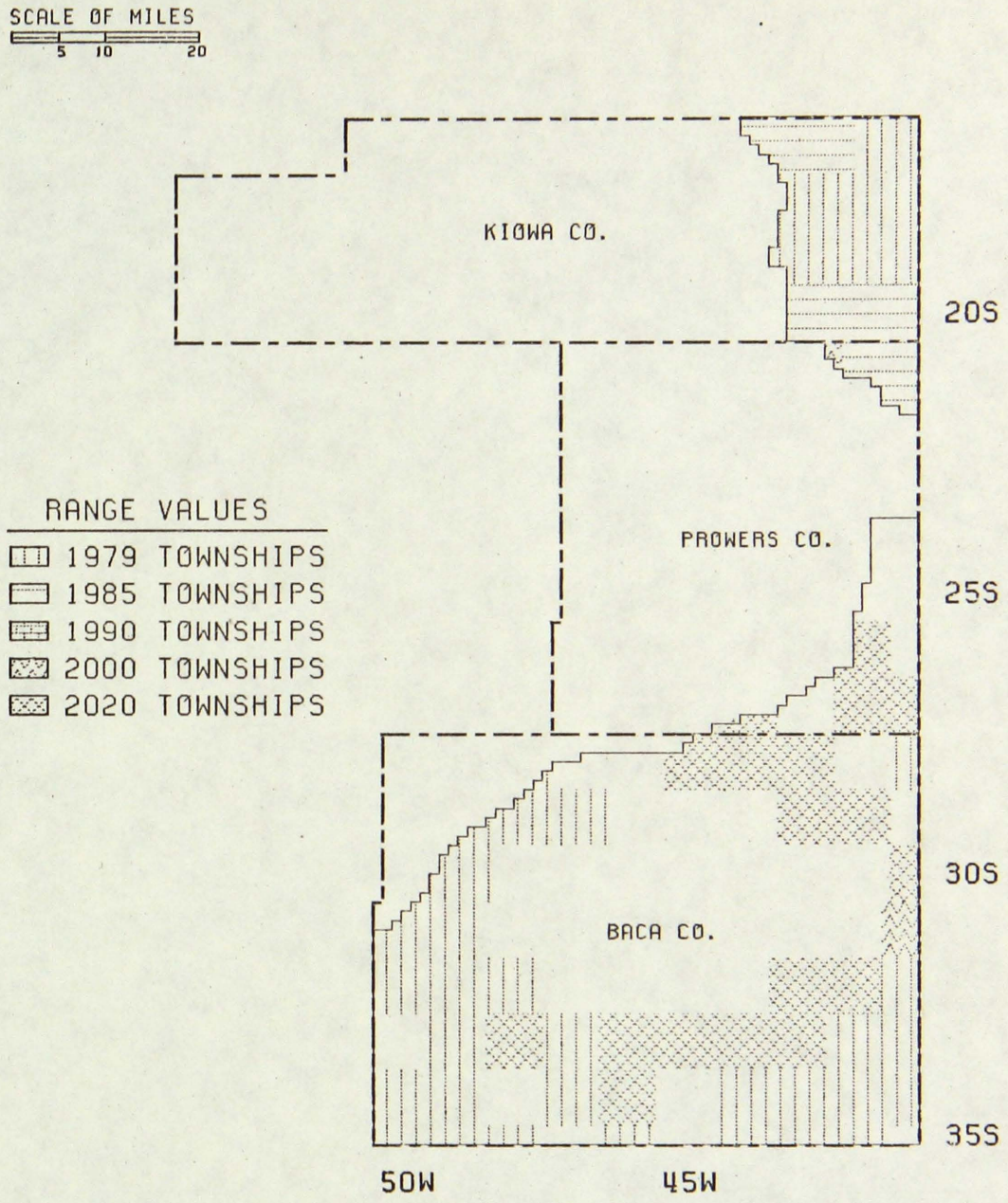
TOWNSHIPS BY 2020 DEPTH-ZONES



OGALLALLA AQUIFER, NORTH-EASTERN COLORADO
IRRIGATION REMOVED BY SIMULATION



OGALLALLA AQUIFER, SOUTH-EASTERN COLORADO
IRRIGATION REMOVED BY SIMULATION

Research Responsibilities

In order to accomplish a study of this magnitude, specific research elements have been assigned to study participants.

The six states are assigned the responsibility for state agricultural and farm-level research, energy production impacts, water resources evaluation and impacts research.

The general contractor will perform the following regional study elements:

__ Interbasin transfer assessment
__ National and regional impact assessment
__ Agriculture and water assessment
__ Environmental impact assessment
__ Unconventional water supply assessment
__ Institutional assessment
__ Crop prices assessment
__ Energy price and technology assessment
__ Dryland farming assessment
__ Nonagricultural development and potential assessment
__ Alternative development strategy assessments

Congress directed the Corps of Engineers to examine the feasibility of interbasin transfer of water from potential sources of supplemental water within the Ogallala study area and adjacent areas. The Corps will lay out conveyance routes and estimate energy requirements, as well as estimate costs of diversion, conveyance and terminal storage facilities. The Corps will evaluate the engineering aspects of the alternatives and identify significant environmental impacts along each proposed water transfer route.

Environmental Impact Statement

An environmental Impact Statement (EIS) will be published on the High Plains Study. The EIS will evaluate, on a programmatic or areal basis, the potential environmental impacts of implementing the study's alternative regional development strategies that will be considered by the High Plains Study Council. The draft EIS will present in broad terms the environmental consequences associated with each of the strategies. The level of specificity depends upon available information. The results should be adequate to support informed decisions. The final EIS will specifically address those alternatives that are recommended by the High Plains Study Council. Anyone wishing to comment or obtain further information on the EIS may contact EDA's Special Assistant for the Environment, Room 7217 U.S. Department of Commerce, Washington, D.C. 20230, Phone, (202) 377-4208.

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(402) 471-2081

New Mexico Interstate Stream Commission
Bataan Memorial Building
State Capitol
Santa Fe, New Mexico 87503
(505) 827-2128

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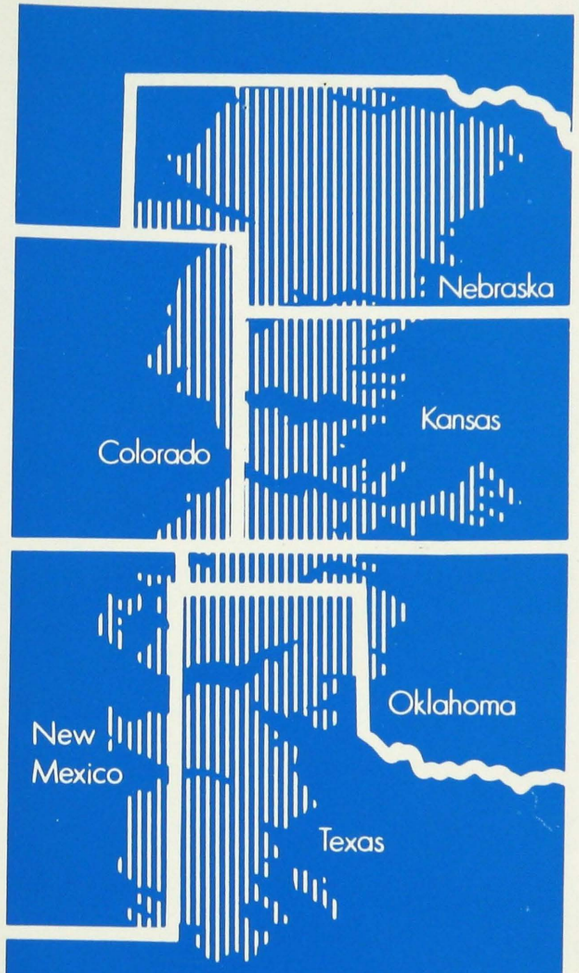
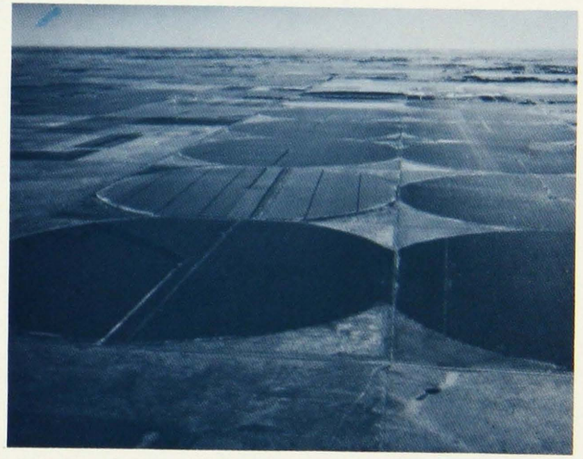


HIGH PLAINS OGALLALA AQUIFER REGIONAL STUDY

The High Plains Study

Lying near the heart of the Nation and nourishing its vital agricultural economy is the fertile High Plains Region, a corridor 200 miles wide touching vast expanses of Colorado, Kansas, Nebraska, New Mexico, Oklahoma and Texas. Beneath the 225 thousand square mile study area region lie petroleum deposits and the Ogallala Formation. The Ogallala Formation, one of America's major aquifers, contains on the order of two billion acre-feet of water in storage; but over most of the area, water is being withdrawn for irrigation in excess of the rate of natural replenishment.

The pumping of ground water -- first begun in the 1930's to wet the wind-ravaged lands of the Dust Bowl -- continues to grow and threatens to exhaust the water supplies of the Ogallala in the foreseeable future.



This vast water resource, along with an abundance of fuel to pump the water to the land above, caused irrigated agriculture to flourish between 1950 and the mid-seventies. It is estimated that irrigated agriculture has increased each year at an average rate of 7.5 percent. And each year hundreds of new wells plunge ever deeper into the aquifer's water reserves, augmenting the Region's meager 10-20 inches of annual rainfall, and irrigating over 16 million acres of food and fiber crops in the High Plains.

Almost two million people live and work in the Region and countless others depend upon the area's economy for jobs and income.

Using water of the Ogallala and fuel from the underlying petroleum bearing formations, irrigation transformed the semi-arid landscape of the High Plains into millions of acres producing bountiful crops for national and world markets. Using water nature had stored within the Ogallala, the agricultural productivity of the High Plains grew dramatically, and spawned a dynamic, complex agricultural economy. Likewise, the production of large percentages of national supplies of crude oil and natural gas greatly enhanced the economy of the High Plains Region.

Crude oil and natural gas production in the High Plains Region increased to a peak production of over 600 million

barrels per year by 1973, while natural gas production exceeded four trillion cubic feet per year by 1972.

Between 1954 and 1973, feed grain production in Kansas, Colorado, Texas and Oklahoma increased 275 percent from 129 million to 386 million bushels, according to government statistics. This grain production in turn triggered the rapid development of the feedlot industry. Prior to 1960 the number of cattle on feed in the High Plains Region was insignificant. However, by 1973, the Region was marketing ten million cattle annually, forty percent of the beef marketed in America.

Along with increasing grain yields and increasing numbers of cattle, associated products -- irrigation equipment, farm machinery, chemicals, and processing plants -- also grew because they were necessary to support the Region's dynamic agricultural economy.

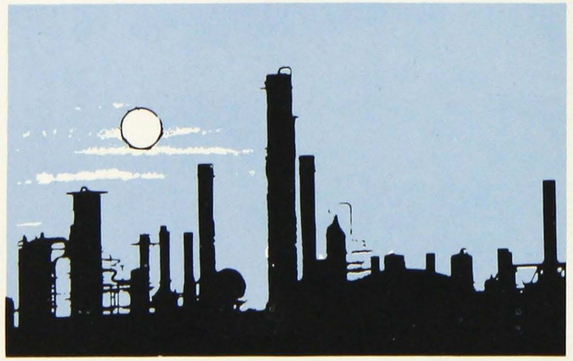
This immense productivity, based on abundant water and excellent petroleum reserves, meant low cost fuel, food and fiber for the nation and economic vitality for the people and the communities of the High Plains. And, it literally sprung from the water of the Ogallala aquifer and the petroleum resources of the region.

The Problem

It was once popularly held that the vast water resources of the Ogallala were inexhaustible. It was once popularly held that cheap, abundant energy was perpetual. Neither is true.

Consider this from a recent government report: "The most dramatic instances of groundwater overdraft are found in the High Plains area that extends from Texas to Nebraska where the annual overdraft is about 14 million acre-feet, an amount nearly equal to the natural flow of the Colorado River."

At many locations within the Region, recharge to the aquifer is negligible, thus, this source of water will be exhausted with continued use. In some areas, exhaustion of the water supply may occur within 10 years, while other areas with lower withdrawal rates or having thicker deposits will not be exhausted within the next 50 years.



Petroleum production, especially natural gas, in the region has decreased significantly since reaching its peak in the early 1970's. By the year 2020, even with more expected drilling activity and enhanced recovery techniques, recoverable reserves of natural gas are expected to be approximately 30 percent of current levels and crude oil 10 percent of current levels.

Consider these projections: In 1977 the cost of electricity to pump one acre foot of water for irrigation was $16.84. In ten years that cost will rise to $39.07, and by 1992, it is projected the cost of electricity to pump one acre foot of water will be $63.91. Similar increases are in store for other energy sources.

These projections prompted one high level government official to observe: "It could be that increasing energy and pumping costs in recent years might cut short the financial benefits of irrigating before the water runs out."

Ever increasing energy costs, combined with the reality of a declining water table in some areas of the High Plains, has obvious implications for the nations food supplies and the Region's economy...an economy based on irrigated agriculture. Those implications are discussed in the Six-State High Plains-Ogallala Aquifer Area Study Interim Report: "There are choices, however, remaining for the future of this region. The resources base is not gone, although it has been significantly diminished. The world energy crisis has caused here--as elsewhere -- major cost-price changes. The economy is still healthy--but is tied to a reliance on declining resources support and increasing costs of inputs."

"The problem, then, is to determine how, to what extent, and by what actions by whom the irrigated agricultural economy of the High Plains can be sustained (or perhaps expanded) and the economic vitality of the region maintained."

The Response to the Problem

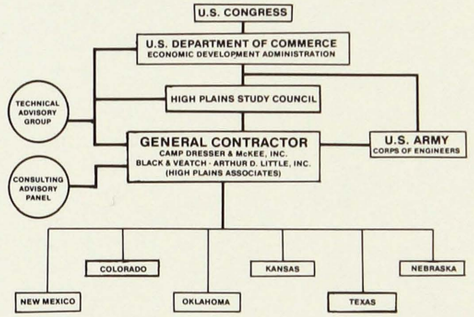
In response to the concern expressed by the phase "...before the water runs out..." Congress stated its intention in Section 193 of Public Law 94-587:

"In order to assure an adequate supply of food to the nation and to promote the economic vitality of the High Plains Region, the Secretary of Commerce... is authorized and directed to study the depletion of the natural resources of those regions...presently utilizing the declining water resources of the Ogallala aquifer, and to develop plans, to increase water supplies in the areas and report thereon to the Congress...In formulating these plans, the Secretary is directed...to examine the feasibility of various alternatives to provide adequate water supplies to the area...to assure the continued economic growth and vitality of the region..."

In order to accomplish the intent of Congress as expressed in this law, six states of the High Plains Ogallala Region with the Economic Development Administration (EDA) of the United States Department of Commerce, formed the High Plains Study Council to carry out the study. Congress appropriated $6 million to fund the study.

Other government agencies and private consulting engineering firms, as shown in the following organization chart, are also involved in the work of the study:

STUDY ORGANIZATION



The Objectives of the Study

The objectives of the study as specified by Congress in the authorizing legislation are:

- to assure an adequate supply of food to the nation;
- to promote the economic vitality of the High Plains Region;
- to develop plans to increase water supplies in the area;
- to assure adequate water supplies to the area; and
- to assure the continued growth and vitality of the region.

Choices..... Difficult Choices

National and regional decision-makers must be provided with reasonable and effective choices in coping with the dwindling water supplies of the Ogallala aquifer. The development strategies must be based on sound research and accurate forecasts of long-term effects. The Six-State High Plains-Ogallala Aquifer Area Study considers the following six such alternatives:

- to initiate no new public action or deliberate change, but instead continue trends in current practices of water and agricultural management in both public and private sectors;
- to voluntarily reduce water use by providing incentives designed to encourage technological change and improved water and agricultural management practices at the farm level;
- to provide incentives for voluntary and mandatory reductions of water use by regulating water use or restricting new irrigation development;
- to require management of water supplies and reductions of water use by augmentation of local area water supplies through weather modification, artificial recharge and other means; and through alterations in cropping practices;
- to evaluate subregional water importation systems (provided long-term surpluses are available) as well as voluntary and mandatory manage.nent of water supplies and demands; and
- to evaluate both regional and large-scale interbasin water transfer systems.

It should be noted that some of the above alternatives have been implemented to some degree by several public and private entities within the High Plains Region. However, the magnitude and the complexity of the problem demands a systematic and comprehensive approach in the areas of research, technology development, management, and implementation.

Colorado
High Plains
Advisory Committee

Colorado
Department of
Agriculture

1525 Sherman Street
Denver, Colorado 80203
(303) 839-3218

High Plains Study

February 18, 1981

Dear Moderators and Panel Members:

The High Plains Conference scheduled for March 3, 1981 at the Ramada Inn in Burlington, Colorado will be the first meeting to preview the research results of the Colorado portion of the High Plains Study. This six-state $6 million study was authorized by Congress to develop water supply augmentation and water demand strategies for the High Plains areas dependent upon the Ogallala Aquifer. The Colorado portion of the study is being conducted jointly by four state agencies and Colorado State University. A Colorado High Plains Advisory Committee has been created to disseminate information about the project in Colorado and to review water supply and demand strategies that will be developed by Camp Dresser & McKee, general contractor for the project. At the March 3rd Conference the Committee and conference participants will review Colorado's research results to this point in time.

PLEASE:

1. Check your title and agency/organization affiliation on the enclosed agenda and advise the department of any changes by February 26.
2. If you have need of audio-visual equipment, notify our department by February 26 at 303-866-3219.
3. Make your own reservations at the Ramada Inn for the night of March 2 no later than 6 days before the conference. Indicate to the reservation agent that you would like a room in the block of rooms that has been been reserved by the Colorado Department of Agriculture.
4. If you need a ride from Denver to Burlington the afternoon of March 2, we will have vehicles leaving from 1525 Sherman at 3:00 and 5:00 p.m. Notify the department by February 26 to reserve a seat.
5. Provide the department with a biographical sketch of yourself (title, agency/organization, etc.) by February 26.
6. If you have expenses to attend the conference that you can't cover, please contact the department at once.

The evening of March 2 at 8:00 p.m. in the Ramada Inn Game Room there will bee an informal meeting so that panel members, moderators, and the advisory committee can become acquainted. If you will be unable to attend this meeting, notify the department by February 26.

Sincerely,

Mark Matulik

Mark Matulik

MM:bcw

Colorado
High Plains
Advisory Committee

Colorado
Department of
Agriculture

1525 Sherman Street
Denver, Colorado 80203
(303) 839-3218

High Plains Study

HIGH PLAINS CONFERENCE AGENDA

DRAFT COPY

7:30 - 8:30 a.m.	Coffee and registration
8:30 - 9:00 a.m.	Welcome--David Foy, Washington County Farmer and Commissioner
	Slide Presentation: The Ogallala Aquifer
9:00 - 9:30 a.m.	Remarks--Richard D. Lamm, Governor, State of Colorado; Morgan Smith, Commissioner, Colorado Department of Agriculture
9:30 - 10:10 a.m.	Colorado Research: Assumptions and Procedures, Dr. Robert Young, Department of Economics, Colorado State University; Dr. Robert Longenbaugh, Deputy State Engineer, Colorado Division of Water Resources
10:10 - 10:25 a.m.	Coffee Break
10:25 - 11:25 a.m.	Colorado Research: Results
11:25 - 12:15 p.m.	Six-state Overview: Harvey Banks, Project Director, Camp Dresser & McKee
12:15 - 1:30 p.m.	Lunch
1:30 - 2:15 pm.	Water Importation: Tom Kincheloe, P.E., U. S. Corps of Engineers, Southwest Division, Dallas, Texas
2:15 - 2:30 p.m.	Coffee Break
2:30 - 4:00 p.m.	Special Topics (choose one)

- Production Agriculture--(Arena) Crop production with little or no water. Minimum tillage, alternate crops, and irrigation scheduling will be discussed.

  Moderator: Doyle Neiman, Farmer, Sterling, CO

  Panel members:

  Darryl Smyka, Director, Great Plains Experiment Station, Akron, CO

  Duane Konrad, , Rural Electric Associations

  Wayne Chakroff, Researcher, Great Plains Experiment Station, Akron, CO

  Ed Langon, Extension Agent, Southeast Area Extension Service

(MORE)

- Water Supply--(Dance Floor) Interstate (continuation of Corps of Engineers presentation) and intrastate (Trans County) water importation possibilities will be discussed during this session.

  Moderator: Gary Friehauf, Engineer, Lower South Platte Water Conservancy District, Sterling, CO

  Panel Members:

  Tom Kincheloe, P.E., U. S. Corps of Engineers, Southwest Division, Dallas, Texas

  Greg Bamford, P.E., , Trans County Water District

  Fred Wurtsmith, Manager, YW Groundwater District

- Energy Supply--(Red Room) Can efficient energy be produced to meet future demand? At what cost? Is there enough demand for energy to pay for existing systems?

  Moderator: Norm Smith, Farmer, Walsh, CO

  Panel Members:

  Emm McBroom, Project Manager, Office of Energy Conservation

  Gene Bishop, Direstor, YW Electric

  Jim Chapel, , YW Electric

  Bill Eisley, , Tri-State

- Social and Community Impacts--(Game Room) The impact of the declining aquifer on government services, schools, health services, and other social concerns will be examined.

  Moderator: J. A. Spiers, Banker, Yuma, CO

  Panel Members:

  Robert Burns, Researcher, Colorado Division of Planning

  Rol Hudler, Editor, Burlington Record, Burlington, CO

  Darrel Bailey, City Administrator, Lamar, CO

  , , Texas

- Research Techniques--Description of linear programming and groundwater hydrology models.

  Panel Members:

  Dr. Robert Young, Department of Economics, Colorado State University

  Dr. Robert Longenbaugh, Deputy Water Engineer, Colorado Division of Water Resources

  Larry Conklin, Research Associate, Department of Economics, Colorado State University

  Dick Gardener, Research Assistant, Department of Economics, Colorado State University

4:00 - 4:30 p.m. Wrap Up--David Foy, Farmer and County Commissioner, Washington County

Table . Forecasted Commodity Prices and Yields for Ogallala Aquifer Region, Colorado, Selected Years.

Crop	Unit	Subarea	1979	1985	1990	2000	2020
		A. Prices Per Unit (1979 dollars)					
Corn	Bu.		$ 2.60	$ 3.07	$ 3.11	$ 3.32	$ 3.49
Sorghum	Bu.		2.20	2.59	2.63	2.82	2.95
Wheat	Bu.		3.50	3.26	3.29	3.36	3.66
Pinto Beans	Cwt.		24.00	24.40	24.70	26.00	28.00
Sunflowers	Cwt.		10.00	11.20	10.85	11.30	12.60
Sugar Beets	Ton		30.00	32.45	32.85	34.55	37.20
Hay	Ton		54.00	62.50	63.00	65.40	67.20
		B. Yields Per Acre					
Irrigated Crop Yields (full irrigation)							
Corn	Bu.	1,2,3,4,5	130.0	142.0	152.0	167.0	187.0
		6	120.0	132.0	142.0	157.0	177.0
Sorghum	Bu.	1,2,3,4	60.0	66.0	71.0	76.0	86.0
		5	75.0	81.0	86.0	91.0	101.0
		6	90.0	96.0	101.0	106.0	116.0
Wheat	Bu.	All	50.0	54.0	58.0	66.0	81.0
Pinto Beans	Cwt.	2	17.0	17.1	17.2	17.5	18.0
		3,5	16.0	16.1	16.2	16.5	17.0
Sunflowers	Cwt.	All	18.0	21.0	24.0	27.0	33.0
Sugar Beets	Ton	2	19.0	19.1	19.2	19.5	20.0
		3,5	17.0	17.1	17.2	17.5	18.0
Alfalfa	Ton	All	4.5	4.7	5.0	5.5	6.0
Non-Irrigated Crop Yields							
Corn	Bu.	1,2	30.0	32.0	34.0	36.5	41.5
		3,5,6	20.0	22.0	24.0	26.5	31.5
Sorghum	Bu.	1,2,3,5,6	20.0	21.5	22.7	25.2	30.2
Wheat	Bu.	1,2	32.0	35.0	37.5	41.5	46.5
		3	25.0	28.0	30.5	34.5	39.5
		4,5	22.0	25.0	27.5	31.5	36.5
		6	18.0	21.0	23.5	27.5	32.5
Sunflowers	Cwt.	1,2,3,5,6	9.0	10.0	11.0	12.0	14.0
Pinto Beans	Cwt.	2,3,5	3.0	3.0	3.0	3.0	3.0
Grass Hay	Ton	All	1.0	1.0	1.0	1.0	1.0

Table . Projected Energy and Energy-Related Prices (1979 dollars).

Item	Unit	1979	1985	1990	2000	2020
Electricity	¢/KWH	5.00	6.20	6.90	8.70	9.70
Natural Gas	$/MCF	1.70	4.42	6.45	6.80	7.15
Diesel Fuel	$/Gal.	0.80	1.08	1.09	1.13	1.18
Gasoline	$/Gal.	0.90	1.10	1.12	1.14	1.18
Anhydrous Ammonia	$/Lb.	0.09	0.18	0.25	0.26	0.27
Other Fertilizer	$/Lb.	0.11	0.17	0.22	0.23	0.24