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REGIONAL

CLIMATE

COORDINATING

OFFICE

R C C O

Annual Report

September 1981 to August 1982

John L. Vogel, Stanley A. Changnon, Jr.,  
and  
Wayne M. Wendland

Illinois State Water Survey  
Champaign, Illinois 61820

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## INTRODUCTION

The Regional Climate Coordinating Office (RCCO) was established in Champaign, Illinois, in September 1981 as part of a plan devised by the North Central Regional Research Committee, "Characterization of the Climate and Assessment of its Impact on Agriculture and other Renewable Resources", identified as NC-94, to develop a regional intergovernmental climate program within an existing institutional framework that includes data management and impact studies for a 12-state region. (Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin). The RCCO is part of a 4-year project 1) to upgrade the climatic services within the North Central Region, and 2) to demonstrate the feasibility of the regional approach, for the provision of climate services. The funds for RCCO are provided by the National Climate Program Office (NCPO) and the State of Illinois.

## CLIMATE PROJECT GOALS AND OBJECTIVES

The overall goal of the NC-94 Plan, entitled, "A Regional Inter-governmental Climate Plan for the North Central United States", is to develop an infrastructure to coordinate climatic studies, advisory services, and data management activities in several states. The key components of this plan are 1) 12 State Climate Centers and 2) the Regional Climate Coordinating Office.

The lines of communication among federal agencies, state climate centers, and users prior to the initiation of the NC-94 Climate Plan were

not uniform (Fig. 1). Information flow from federal agencies to State Climate Centers was dependent upon the level of communications which had been developed between the State Climate Centers and federal agencies, and varied from no communications to full communications. The state boxes represent the varied levels of support for State Climate Centers within the North Central states. The level of support for basic climatic services at some State Climate Centers is almost non-existent, others possess only a minimum of services, while others are able to maintain various research projects in addition to providing basic climatic services to users. An objective of the full implementation of the North Central Climate Plan is to provide a data and information communication system between federal, regional, and state agencies. The general flow of information from federal agencies and State Centers will be achieved through RCCO, as shown in Fig. 2. A second objective of the 4-year demonstration project is to bring all 12 State Climate Centers to some minimum level of climatic support. The RCCO will provide the central focus: through which- 1) the administration of the NC-94 Climate Plan can be accomplished, 2) the communications between federal, regional, state, and private user groups can be encouraged and maintained, and 3) the coordination of regional goals, climatic data sets, and climatic impact research can be achieved.

The State Climate Centers provide the foundation for the proposed regional program. Thus:, it becomes necessary for the State Climate Centers to achieve a minimum level of climatic services and research capabilities. Some are at this level and others are not. The State Climate Centers are able to maintain close contact with the user groups within each state, and are aware of the specific needs: for their areas so that their efforts can

CLIMATE PROGRAM NOW

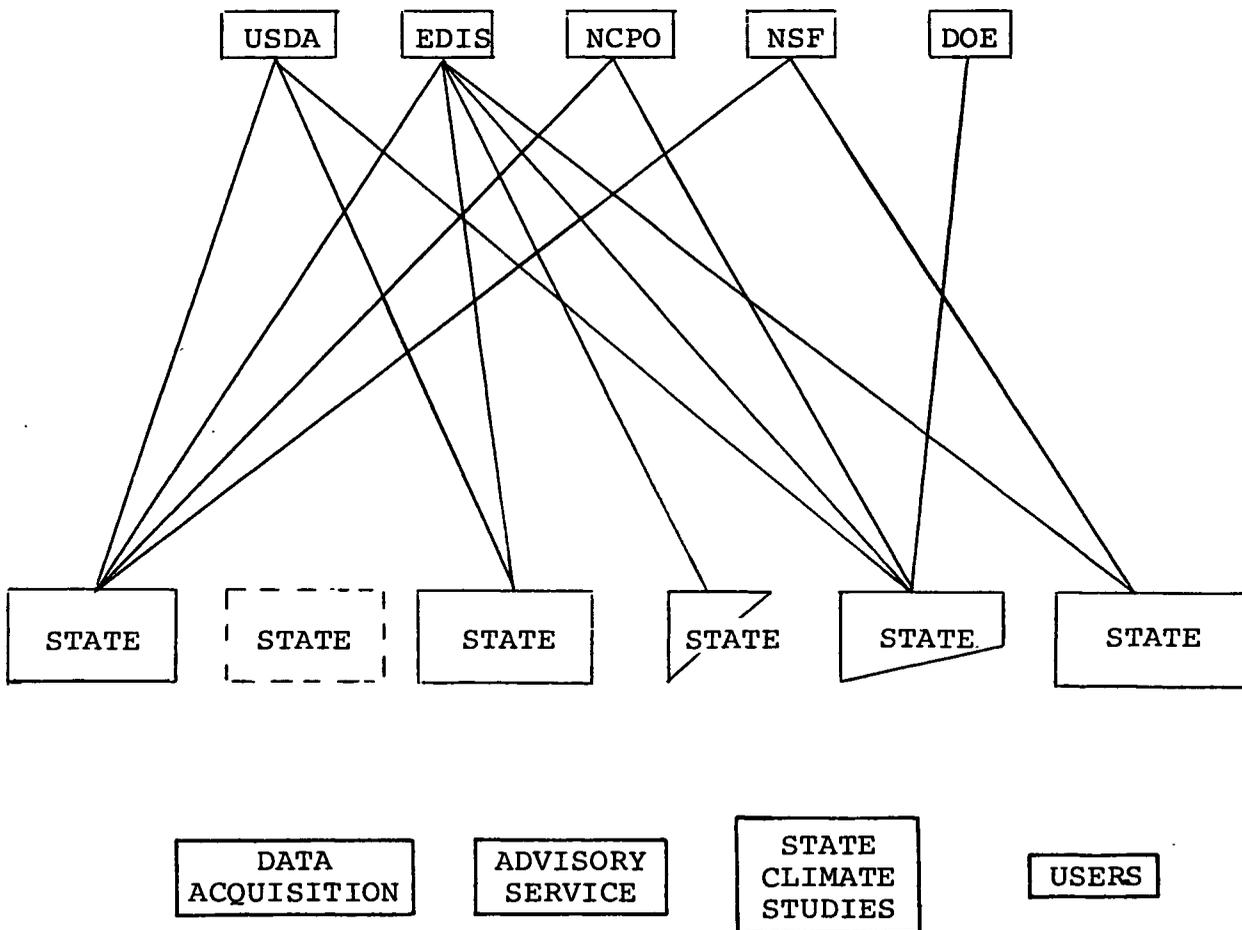


Figure 1. Lines of communication prior to NC-94 plan.

PROPOSED LINES OF COMMUNICATION

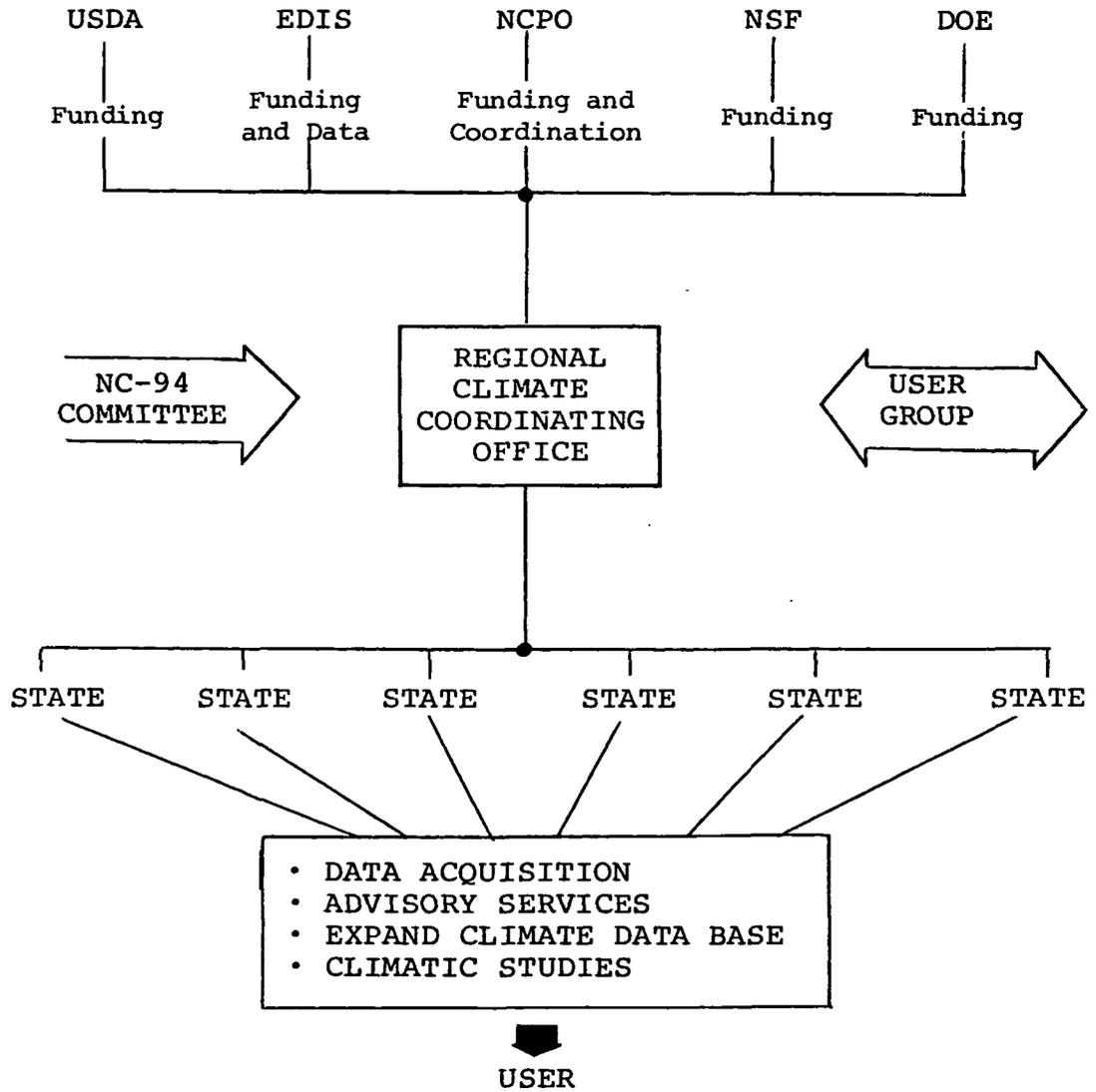


Figure 2. Lines of communication and structure of State Climate Centers at conclusion of NC-94 Climate Plan.

be focused for maximum local benefit. The focal point of communication between the users of the climatic data and information and the NCPO will be the State Climate Centers. The main program components of each State Climate Center are: 1) advisory services; 2) acquisition of data; 3) expansion of climatic data bases for special studies and special needs; and 4) involvement in climatic impact research.

The primary purpose of the RCCO is 1) to improve the efficiency and effectiveness of the State Climate Centers, and 2) to offer a means for all federal agencies involved in climate to have a focal point for communications and cooperation with the states. This is accomplished by: 1) overseeing regional programs housed at State Climate Centers; 2) serving as a clearinghouse of information between State Climate Centers and other state and federal agencies; 3) administering federal funds allocated for regional activities; and 4) advising and assisting State Climate Centers and federal agencies. The RCCO performs the management roles for the regional research committee and remains accountable to NC-94. The major tasks or responsibilities of the RCCO are: 1) program management of projects and funds allocated from federal and other non-state sources for regional work; 2) management of regional climate data, special data networks, and the near real-time collection of climate data; 3) development, promotion, and coordination of regional climatic research and impact studies; and, 4) liaison with federal, state, regional, and private groups within and outside the North Central Region.

This report will summarize the accomplishments of the RCCO in its first year (1 September 1981 to 31 August 1982) by reviewing the progress RCCO has made with the four major tasks assigned by the NC-94 Climate Plan.

Recommendations for the upcoming year and for certain specific tasks assigned to the RCCO will be made. In addition, some preliminary thoughts about the basic philosophy of Regional Climate Offices and factors that affect the efficiency of such regional centers will be made.

#### PROGRAM MANAGEMENT

The RCCO responsibilities in program management are to 1) evaluate and monitor regional programs, 2) monitor the activities of State Climate Centers, and 3) prepare requests for regional funds. During the past year RCCO has 1) prepared a proposal for a computer communications network, and 2) visited all 12 states.

Key components of the NC-94 climate plan are the optimization of climatic services, climatic data bases, and communications. An essential element to all three of these key components is the development of specific hardware to facilitate data management and data communication within the region. The Computer Communication Subcommittee of the NC-94 Committee developed criteria for microcomputers in State Climate Centers. The microcomputers would have the ability to send, retrieve, or develop climatic information for use within State Climate Centers or for communicating between State Climate Centers. The RCCO developed a proposal entitled, "A Climate Data Base Management System for the North Central Region", utilizing the results of the Computer Communication Subcommittee, and forwarded this proposal to the Environmental Data and Information Service in January 1982. This proposal calls for specific hardware to be used in a common manner throughout the region. Since each State Climate Center would have common

hardware, software packages developed at State Climate Centers could be readily exchanged. The proposal calls for a two-year development with the acquisition of 6 microcomputers in the first year and 6 more microcomputers in the second year. At the end of the two-year period it was envisioned that a regional system would have been established. The proposal requests funds only for the acquisition of the basic hardware. The proposal was sent to EDIS of NOAA. Various discussions have been held with EDIS leaders. Reorganization in NOAA and very tight funding have held back any commitments, as of this time.

The 12 State Climate Centers were visited by RCCO staff to 1) become familiar with the personnel and issues in each state; 2) help promote state investments into climatic resources; and 3) identify the resources presently available. At each State Climate Center a single individual was identified as the contact person for that state. This person agreed to disseminate information from RCCO to other members of the State Climate Center. A list of the individuals for each state is given in Table 1.

Illinois - The Illinois State Climate Center is located at the Water Survey in Champaign, Illinois. The State Climatologist is Wayne M. Wendland, and he assisted by Stan Changnon, Keith Hendrie, Peter Lamb, Richard Semonin, Peter Vinzani, Steve Sonka, and John Vogel. This group are able to supply users with general and specialized information. Services are provided in three ways: 1) General and detailed publications of climatic events and parameters, 2) News releases for media throughout Illinois, and 3) Information and data are provided to users on request. The most recent survey of the total number of requests handled in Illinois was run in 1976, and it indicated that 9,588 requests were filled during that year.

Table 1. RCCO Contacts in Each State.

Illinois	--	Wayne M. Wendland
Indiana	--	James E. Newman
Iowa	--	Robert H. Shaw
Kansas	--	L. Dean Bark
Michigan	--	Stuart H. Gage
Minnesota	--	Donald G. Baker
Missouri	--	Wayne L. Decker
Nebraska	--	Ralph E. Neild
North Dakota	--	John W. Enz
Ohio	--	R. Bruce Curry
South Dakota	--	William F. Lytle
Wisconsin	--	Champ B. Tanner

The digital data base in Illinois consist of daily, hourly, and other miscellaneous climatic data collected by the National Weather Service. The daily climatic data for 50 stations have been punched from 1901 or their inception since 1901, and provide the historical data base for Illinois. Additional climatic parameters (temperature, relative humidity, precipitation, wind, soil temperature, soil moisture, and radiation) are available from a climate network which was begun two years ago with six stations. This climate network has now been expanded to 14 stations within the past year. Detailed climatic data to describe the climate of Illinois have been analyzed and reported using special climatic networks which were originally research networks. A monthly summary of climatic and water data sketches the monthly status of the present water resources within the State of Illinois. At the present time the Illinois Climatic Network has no provisions to be used as a near real-time data base.

Illinois also maintains a 4-man advisory panel consisting of users from across the state. This panel provides input to Illinois of the various climatic needs required in the state. The service component in Illinois is supported by the Department of Energy and Natural Resources of which the Water Survey is a Division. Research within Illinois is supported by the State of Illinois as well as by a variety of federal and state agencies.

Indiana -- The Indiana Climate Center is located on the campus of Purdue University and consists primarily of the Department of Agronomy, which until 1 July supported the State Climatologist, and members of the Department of Geosciences. The State Climatologist's position since 1973 has been a half-time position manned by Larry Schaal, supported through Indirect Cost funds within the Department of Agronomy. Within the Department of Agronomy

the key names are James Newman, Robert Dale, and Kyaw Tha Paw U. In the Department of Geosciences the key members are Ernest Agee, Phillip Smith, and Dayton Vincent. Since the retirement of Larry Schaal members of the Department of Agronomy have been actively pursuing state funds to upgrade the State Climatologist's position from a half-time to a full-time, tenure-tracked position. The Indiana Climate Center also cooperates extensively with the Midwest Agricultural Weather Service Center which is co-located with the Indiana State Climate Center in the Department of Agronomy on the campus of Purdue University.

The basic long-term data set used by the Indiana Climate Center consist of daily climatic records for 25 well-spaced stations across Indiana with 10 stations dating from the 1890's and 15 beginning in 1901. Long-term evaporation records are available from 4 stations in Indiana, and additional evaporation records are made as part of the Agricultural Weather Network within Indiana. The real-time data base in Indiana consist of 30 maximum-minimum temperature reports daily, 70 to 100 precipitation stations, and 4 agricultural weather stations in Indiana. Except for the 4 agricultural weather stations most of the data is received by the Indiana Weather Wire. This data is then put on disks or tape storage by hand and made available to other groups through, the Purdue computer.

The real-time data base is used to prepare the climatological part of the Indiana Weekly Weather Crop Bulletin, weekly summaries of precipitation, temperature, and other climatic variables every Monday for the state, and monthly summaries, which are issued 1 to 2 days after the end of the month. Additional releases of the weekly and monthly summaries are made by a facsimile system to Agricultural Extension Agents.

The research objectives by personnel in the Department of Agronomy are primarily micro and biometeorology, environmental quality, acid rain, soil moisture and soil temperature. Within the Department of Geosciences the primary research interests are climatic changes over the past several years and synoptic-climatological projects. The computer facilities and the communication system at Purdue University are excellent.

Iowa -- The Iowa Climate Center consist of: 1) the State Climatologist office at Des Moines, and 2) the Meteorology-Climatology group of Iowa State University at Ames. The State Climatologist is Paul Waite and the principal personnel at Iowa State University are Robert Shaw, Richard Carlson and Elwin Taylor. The major service component for the Iowa State Climate Center is performed by the State Climatologist. In the calendar year 1980 the state climatologist handled 5,000. requests for climatic information. Almost all of these data requests are handled using the paper records maintained in the Iowa State Climatologist's office. The State Climatologist does maintain a complete set of climatic records on magnetic tape, but these can only be used when outside computer time can be made available. At the present time only limited computer funds are available.

The Iowa State Climate Center depends extensively on the cooperative stations to obtain climatic data. These data are processed and received by normal National Climatic Center routes. The only present real-time data received are the weekly cards sent in by selected cooperative observers to the National Weather Service office at Des Moines. The weekly climate cards are used routinely to prepare the climate portion of the Iowa Crops and Weather. In addition this data is also used by the State Climatologist to issue monthly summaries of the climate within Iowa.

The State Climatologist office at Des Moines is located in the same building as the National Weather Service Forecast Office for Iowa. As a result, the State Climatologist and the National Weather Service Office have cooperated extensively in the preparation of climatic summaries and answering climatic requests. The primary function of this office is for service with approximately 20% of the State Climatologist's time devoted to research.

Iowa State University provides the major research component of the Iowa Climate Center. The facilities at Ames, Iowa, include a TI-990 mini-computer system capable of transmitting agricultural weather forecasts and providing real-time climatic data over a phone-fax system to agricultural extension offices within Iowa. At the present time no provision exists for the phone-fax system to be used by the State Climatologist's office in Des Moines. Supplementary climatic information is obtained at Ames through a network of agricultural climate stations. In the future it will be possible to poll the climatic stations and provide this data in near real-time using the TI-990 computer at Iowa State University. The primary research interests of the climatology group at Iowa State University is the application of climatology, especially for agriculturally-related research. Major emphasis has been placed on integrated pest management and evaporation.

Kansas -- The State Climatologist for Kansas is L. Dean Bark of the Department of Physics at Kansas State University in Manhattan, Kansas. Some climatic research is pursued at the University of Kansas at Lawrence, and these two groups, Kansas State and University of Kansas, compose the

Kansas Climate Center. The climatic data base for Kansas has been assembled by Bark at Kansas State University. This data base consist of a large array of paper and magnetic tape records. The tape files for Kansas have been updated through 1980, and an inventory and users manual are available (Owens, 1977).

The service component of the State Climatologist's office at Manhattan is limited to providing data and information for research workers and other elements of Kansas State University. Limited climatic service are necessitated because of limited resources available for service work. It is anticipated that another climatologist will be hired by the Cooperative Extension Service at Kansas State University. It is anticipated that this person will be involved in agricultural extension work, integrated pest management initially. The climatic data base maintained by the National Weather Service is further supplemented by 10 climate stations which have been installed with funding from the Agricultural Experiment Station in Kansas. It is anticipated that these data which presently are obtained and stored on Campbell Recorders will be transmitted in near real-time to a Commodore 8032 microcomputer. This data will be used by the State Climatologist, the National Weather Service Forecast Office in Topeka, and to other potential users through computer storage.

Michigan -- The Michigan State Climatology Office, headed by Fred Nurnberger, is financed by the Michigan Department of Agriculture/Climatology Division. This office is the clearinghouse and service center for climatological data and information for Michigan. The State Climatologist is responsible for the maintenance and storage of climatic data, and for the dissemination of

climatic information within Michigan. Data and climate summaries are done for radio, local television spots, news releases, and for special reports and summaries made available to the people of Michigan. Another dissemination tool is COMMNET (Communications Network) maintained by the Agriculture Experiment Station and Cooperative Extension Service at Michigan State University. This communications network provide a common data base and allows communications to extend from the State Climatologist to University and County Extension Offices. The Michigan Climate Center is completed by the research and service arms available within Michigan State University and the University of Michigan. Key personnel at Michigan State University are Jon Bartholic, Stewart Gage and C. Van Den Brink.

The main data source available to the Michigan Climate Center are the data collected by the National Weather Service and made available through the National Climatic Center. The digital data for Michigan is presently being reviewed to insure good data quality. Estimates are being made for missing data and data are being checked for inconsistencies. More than 40 stations have been verified or checked for either the period of record or from the period 1948 to 1980. The Michigan Climate Center data base is supplemented by three special precipitation networks and supplemental climate stations to document the mesoscale influences of the Great Lakes.

Near real-time data are available to the State Climatologist via the Michigan Weather Wire. These data are received in hard copy form along with weather calendars, FAA hourly data, and other Michigan climatic data. These files are maintained by the State Climatologist and are discarded as digital copies of the data are received. This near real-time information is utilized by the State Climatologist to compile monthly and weekly climate summaries.

Additional near real-time climate data is available through Michigan State University. Michigan State University collects data from 61 climate stations, integrates the data into a computer system, and makes this data available to the extension communications network and to the Michigan State Climatologist. These data are stored on the main-frame computer at Michigan State, a CYBER 170-Model 750. A TERAK microcomputer is available to the State Climatologist, which allows him to link with the main-frame climatic data. The major research arm for the Michigan Climate Center revolves around research activities at Michigan State University and the University of Michigan. These groups are interested in the use of climatic data to evaluate atmospheric processes, for applications in agriculture, and the development of indirect measurement techniques to determine the climate.

Minnesota -- The Minnesota Climate Center is housed at the University of Minnesota at the St. Paul and Minneapolis campuses. The group consists of Earl Kuehnast (State Climatologist), Donald Baker and Mark Seeley (Department of Soil Science), and Richard Skaggs (Department of Geography). Funds for the State Climate Center come from the Minnesota Department of Natural Resources which sponsors the State Climatologist; the Agricultural Experiment Station and Cooperative Extension Services, which helps sponsor work within the Department of Soil Science; University and other research funds.

The main data source for service work at Minnesota is the Cooperative Climate data collected by the National Weather Service. These data are maintained on magnetic tape file by the State Climatologist. The data is examined for errors and corrected, as it is received. In addition the State Climatologist estimates missing data, if possible. At the present time all

summer maximum-minimum temperature data have been adjusted to midnight-to-midnight maximum and minimum temperatures. In the future they hope to adjust all maximum-minimum temperatures to midnight-to-midnight maximum and minimum temperatures. Supplementary data sources consist of 1) eight raingage networks, 2) nine University of Minnesota Agriculture Climate Stations, and 3) soil moisture measurements around the state at least twice a growing season. The raingage networks provide approximately 1,000 additional precipitation stations during the warm season and 600 precipitation gages during the winter. The Agriculture Climate stations provide radiation and soil temperature measurements, as well as temperature, humidity, evaporation, wind, and precipitation.

Near real-time climatic data are available for 40 stations from weekly crop cards sent to the National Weather Service Forecast Office at Minneapolis each week. These data are updated every Monday, and along with data from the special networks are used to issue a wide range of weekly, monthly, and annual climate summaries. One system currently being used to disseminate climatic data is CAWAP (Cooperative Agriculture Weather Advisory Program). This system uses the 40 near real-time climatic stations for its base, and provides updated climatic data for specific areas. The system is also capable of calculating various parameters such as potential evapotranspiration, growing degree days, and other climatically-derived parameters for use in agriculture, transportation, tourism, and utilities.

The Minnesota Climate Center entertains a wide variety of climate-related research. Some of the more important research efforts currently underway are: 1) crop/insect calendars, 2) remote sensing of crops and related stress, 3) the development of crop-pest management data bases, 4) water resources questions as related to Minnesota, 5) climatic cycles, and 6) acid rain variations.

Missouri -- The Department of Atmospheric Science at the University of Missouri houses the Missouri State Climate Center. The principal personnel at this center are Wayne Decker (State Climatologist), Grant Darkow, and Vernon Jones. The biggest user of the State Climatological Center is the Cooperative Extension Service and the University Community. Requests from other users are answered immediately, if the answer does not take much time. However, if more detailed or extensive replies are required, they are answered only if time can be made available. At the present, a full-service State Climate Office does not exist due to a lack of resources. However, in the last year, the service component for Missouri was upgraded with the appointment of a combination research/extension specialist for the integrated pest management program. With this appointment the Missouri Climate Center has been able to make wider use of media coverage to stimulate service-type inquiries from the state.

The Missouri State Climate Center maintains a complete digital record of climatic data from the National Climatic Center and supplements this data with near real-time data from five climate stations maintained by the University of Missouri. Other near real-time data are obtained by the touch-tone data set maintained by the U. S. Department of Agriculture and by adding information from First-Order and FAA hourly reporting stations by hand to a data base maintained on a TI-990 mini-computer. Another data resource is a special data set which identifies the long-term cooperative climate stations representative of crop districts within the United States. These data have been verified, and daily and monthly tapes have been constructed for the period from 1948 to 1978.

The major research interest at the University of Missouri are 1) crop calendar, 2) integrated pest management, and 3) severe weather. The Missouri Climate Center has a considerable amount of on-going climatic research.

Nebraska -- The Nebraska State Climate Center is composed of the State Climatologist Office at the University of Nebraska-Lincoln and research and service activities within the School of Agriculture, the Department of Geography, and the Center for Agricultural Meteorology and Climatology (CAMaC). Key personnel within this State Climate Center are Kenneth Hubbard (State Climatologist), Ralph Neild, Norm Rosenberg, Donald Wilhite, and Blaine Blad.

The Nebraska Climate Center provides both traditional and innovative services. The traditional mode of answering telephone requests, letters, and monthly and weekly summaries are maintained. For this data service, paper and digital records are maintained either by the State Climatologist or the Nebraska Data Bank Resource Center. A near real-time data base consisting of 61 reporting stations is maintained during the crop growing season. These stations report weekly through County Extension Agents. Eight remote stations report daily during the early morning hours by means of a IBM mini-computer. These data are incorporated into the AGNET program developed by Tom Thompson as a management tool within the Crop Weather Information System (C-WIS). This system provides access to the University of Nebraska data files to the farmer, extension agent, or anyone with a terminal. These files have updated climatic data in a routine format of the data can be utilized in conjunction with various software programs as a management tool. Additionally, the near real-time data are used during the crop season once a week by a committee formed within the Cooperative Extension Service. The

conunittee provides near real-time information about crop stages and advice on pests and crops for the remainder of the growing season based on climatic and other data gathered by County Extension Agents.

Research in Nebraska centers around integrated pest management, plant phenology, irrigation scheduling, evaporation, biometeorology, and climate change. The facilities for both service and research at the University of Nebraska are good. The main-frame computer at the University is an IBM 360/370 and the State Climatologist has an IBM minicomputer series 1, model 4952.

North Dakota -- John Enz, North Dakota State Climatologist, has an office at the North Dakota State University at Fargo, North Dakota. The major user of the state climatologis's services in the past has been the university community (approximately 50%), agribusiness, utilities, federal government, and the public. Most climate information is derived from paper records of National Weather Service Cooperative Observers maintained at this office. Additional digital records obtained from the National Climatic Center are available. However, no detailed inventory of the present digital climatic records are available. It is hoped that in the near future the service component will be upgraded with the addition of an Agricultural Climatologist, who will be funded from the Cooperative Extension Service and the Agricultural Experiment Station.

Other components of the North Dakota State Climate Center are the North Dakota Weather Modification Board at Bismarck and the University of North Dakota at Grand Forks. Both of these centers maintain climatic data sets for use in their research. Some key personnel within the North Dakota Climate Center are John Enz, Lynn Rose, John Foss, Lynn Brun and Patrick Brady.

The major research emphasis within North Dakota are integrated pest management, solar radiation, weather modification, crop calendars, soil moisture, and water resources.

The North Dakota Climate Center supplements observations taken by the National Weather Service Cooperative Network with some statewide soil moisture monitoring, and climate records available from a station at Fargo on the campus of North Dakota State University. Hail and special precipitation records are maintained by the North Dakota Weather Modification Board in Bismarck for the period from April to September. These special observations consist of approximately 500 to 600 additional precipitation and hail data measurement points available since 1975.

Ohio -- The Ohio State Climatology Center is broken into three groups: 1) the State Climatologist, John Rayner, located in the Department of Geography at Ohio State University at Columbus; 2) the Agricultural Experiment Station at Wooster, part of Ohio State University; and 3) a Climatic-Water Resources group at Miami University of Ohio at Oxford. Other key personnel are Bruce Curry (Wooster), John Klink (Oxford), and Gene Willeke (Oxford). The State Climatologist does not presently have many resources available for services, but he is able to maintain the data base. However, the State Climatologist is unable to fulfill any more than cursory service commitments. Historical data sets are maintained at both Wooster and Columbus. Real-time climatic data are available from an eight-station climate network with temperature, precipitation, humidity, wind, radiation and soil temperature measurements. These data bases are maintained at Wooster and Oxford.

The total amount of climate data available in Ohio are only partially known. An inventory of the digital records were made at Columbus, but a complete inventory of the historical data set needs to be made. No summaries of climatic data are published within the Ohio Climate Center at this time. The principal research interests within Ohio are soil moisture, water resources, solar and wind energy, precipitation, and crop calendars.

South Dakota -- William Lytle, the State Climatologist, has an office at the South Dakota State University at Brookings. The lead agency for developing a climate plan for the South Dakota Climate Center is the Department of Water and Natural Resources. In addition to William Lytle, who has both teaching and research responsibility, the South Dakota State Climatologist office is supported by a full-time service employee responsible for reading and key-punching climate data.

The service activities at the South Dakota Climate Center consist of providing climatic data and information to various university personnel, answering questions from various engineering and consulting firms and the general public, and providing weekly, monthly, and annual summaries. Weekly summaries are made for the Weekly Climate and Crop Bulletin. Monthly and annual summaries are distributed by a radio network and on public television channels. The near real-time data base for the South Dakota Climate Center consist of weekly cards sent in by cooperative observers, provided by the Sioux Falls National Weather Service Forecast Office, and data obtained from the South Dakota Weather Wire.

The primary data resource in South Dakota are data provided by the National Climatic Center. However, these data are supplemented by special

climatic observations taken at Agricultural Experiment Field stations around South Dakota, and from a special network of precipitation and hail measurements maintained from April through September by the Department of Water and Natural Resources. The primary research interest at South Dakota are drought, water resources, wind and solar energy research, and the application of climatic data to agricultural needs.

Wisconsin -- The Wisconsin Climate Center consist of five major components. They are: 1) the State Climatologist, 2) the Institute for Environmental Studies, 3) the Department of Meteorology at the University of Wisconsin-Madison, 4) the Department of Geography at the University of Wisconsin-Madison, and 5) the Department of Atmospheric Sciences at the University of Wisconsin-Milwaukee. Val Mitchell was the State Climatologist until 1 July when he retired. At the present time a nation-wide search is being conducted to find another State Climatologist. The State Climatologist is sponsored by the Wisconsin Geological and Natural History Survey which is funded by the University of Wisconsin extension. The Wisconsin Climate Center has a climate advisory committee consisting of three individuals: 1) the State Climatologist, 2) Dhirenda Sikdar, and 3) Reid Bryson. Other key personnel involved in the Wisconsin Climate Center are John Kutzbach, W. Brinkmann, Buz Ostrom, and Chuck. Engman.

The Wisconsin State Climatologist's Office provides a good service base for Wisconsin utilizing the National Climatic Center data base as its prime data source. At the present time no near real-time data are received by this office, other than weekly cards. However, the Wisconsin data base is supplemented by a number of climate stations some of which are supported by

the Agricultural Experiment Station and others by local or regional agencies within Wisconsin. An additional data base available at the University of Wisconsin through the Department of Geography is precipitation and temperature data in the United States and Canada for approximately 160 stations around the Great Lakes. This data base has long-term station records which begin in 1900 and have been updated to 1978.

Included within the computer facilities at the University of Wisconsin is the McIDAS computer maintained by the Department of Meteorology at the University of Wisconsin. This computer system is a very sophisticated, interactive computer used for rapid access and analysis of data. The University of Wisconsin also maintains a Laboratory for Carbon Dating. In addition, a complete record of the GOES satellite data are maintained at the University of Wisconsin. The major research topics pursued in climatology at the University of Wisconsin are irrigation, water resources, integrated pest management, acid precipitation, climate change, satellite applications, and long-range climate forecasting. A large number of other climatically related research topics are also pursued within the Department of Meteorology.

#### DATA MANAGEMENT

The RCCO has four responsibilities assigned in data management. They are: 1) to monitor and supervise data collection or data management programs adopted by the regional research committee; 2) to coordinate special observational programs; 3) to design compatible formats for climatic data; and 4) to design systems for the near real-time collection and exchange of weather

and climate data between State Climate Centers and national groups. During the first year there were no designated regional data collection or data management programs, nor were there any special observations programs within the North Central region. However, RCCO did address parts of the last two tasks.

During our visits at the State Climate Centers it was realized that the design of computer formats for the exchange of historical data for research or for the near real-time collection of data depends heavily on the use of the data and on the types of computers available at the various institutions. For example, in some instances no matter what the data format, the user will immediately translate the computer data into a format compatible to the user's computer; e.g. SAS. Another problem which must be considered are the differences in computer systems. For example, IBM and CYBER systems are not compatible because of different variable record lengths. This could present a problem in formatting data, and such difference could require format changes in the future.

The major requirement most researchers have upon receiving a "historical" data set from another institution is that the group supplying the data also supply a detailed enough explanation about the manner in which the data is stored. Once the researcher is supplied with a detailed format it becomes relatively easy for the group receiving the data to format the data into the desired format for use on a particular computer.

In addition, the National Climate Center is presently redesigning their data format into element arrays. This new format has the advantages of doing away with over punches and provides a reasonable data management system

which is economical for their use. Until more experience is gained within the region using this format, it would be premature for any recommendations to be made for the design of a common computer format for historical climatic data sets. The National Climatic Center also has plans to accelerate the data exchange process through the use of both micro- and main-frame computers. Thus, it makes more sense for the RCCO to work with the National Climatic Center and State Climate Centers in designing formats which will allow for the easy transferral of historical and near real-time data sets over long lines, satellites, or whatever other mode may be compatible for computers and/or microcomputers at State Climate Centers.

Data Acquisition System -- In February 1982 the Central Region Office of the National Weather Service developed a proposal entitled "A Comprehensive Data Collection System for Central Region." This proposal called for a data acquisition system designed to facilitate the collection of Service A and subsidiary data; e.g., hydrological, substation, agricultural, and marine. The system revolves around 4 microcomputers in different locations across the region. These 4 microcomputers will collect data from observers who input the data by a touch-tone encoder. This encoder has the capacity of accepting and storing the observation prior to phoning the microcomputer. After the observation is stored in the encoder, the observer calls the microcomputer which will have several available ports. After the phone call is placed, the encoder transmits the observation in seconds to the microcomputer. These data will then be periodically placed, as required, on AFOS.

The initial design, as conceived by the Central Region, of this data acquisition system was that it would poll data for Service A, marine

observations, hydrological observations as well as other miscellaneous observations. Cooperative Stations participating in the hydrologic observation program would provide precipitation data on an event basis only. There was no provision for incorporating climatic data from Cooperative Stations on a near real-time basis. After consultation with the Central Region and Washington offices of the National Weather Service it was decided that some Cooperative Station data would be placed on this system on a daily basis. Initially, 6 to 7 stations per state will be available through this system. As time progresses and the system is further tested it is envisioned that some 20 to 30 Cooperative Stations per state within the North Central region will be handled by this system. This gives a station density of one Cooperative Station every 2200 miles<sup>2</sup> or a station spacing of 1 station every 47 miles (75 km).

The present design calls for these stations to be transmitted from the microcomputers to AFOS. The data will then be received by the NWS Midwest Agricultural Weather Service Station at Purdue, and these data will be made available to other users by the Purdue computer system. The RCCO has worked extensively with the Central Region office to help obtain this data and make it available to the North Central region. RCCO will coordinate the stations selection in the 12-state region and will also coordinate the station selection in Colorado and Kentucky. Both of the latter states are part of the Central Region of the NWS, and have been briefed.

#### COORDINATION OF SPECIAL STUDIES AND INVESTIGATION

The Regional Climate Coordinating Office is to be involved with those special studies and investigations which involve more than one State Climate

Center or are being undertaken at the direction of the NC-94 Committee. This includes 1) the development and promotion of climatic research and special studies; 2) the encouragement of climatic impact studies for industries other than agriculture, 3) the administration of review procedures, and 4) the monitoring of regional funds. This task was begun in October 1981 at the annual meeting of the NC-94 committee, when RCCO suggested 12 potential research topics. The NC-94 research committee directed that several topics be added to the list and that a survey be made of the research committee. This survey attempted to 1) determine the priority of the research topics within the region and at each State Climate Center, 2) identify the personnel most likely to be interested in working on the topics, and 3) ascertain if any unique data sets reside at individual State Climate Centers. The surveys were mailed on 27 October 1981, and it was expected to have all responses in hand by 1 December. However, all surveys were not returned until mid-March.

The survey identified three research topics of interest to many of the State Climate Centers within the region. The first research topic was a study of the impact of climate variability on crop production. The questionnaire suggested that this study could involve a detailed inventory of climatological events (e.g., extent and magnitude of hailstorms, floods, strong winds, drought, and others), and the impact of temperature and precipitation on crop yield. The second research topic was the development of a regional soil moisture model. The model would be developed for various soils and precipitation-temperature regimes. Such a model would require extensive field work over a large area and the results from this model would be of vital interest to the agricultural community. The model would be developed for various soils, slopes, aspects, drainage, and land uses as a

method of calculating present soil moisture, and when coupled with short-term forecasts the model could predict probable future moisture conditions. The third research topic which was supported by many members of the region was the integration of integrated pest management and climate. This program like the regional soil moisture model, would be developed for various conditions and locations. These results were forwarded to the NC-94 representatives on 22 March 1982. At the same time the RCCO attempted to 1) identify the specific participation of each State Climate Center in the research project, 2) have each state write a portion of the proposal which they were involved in, and 3) define budget estimates from each state.

We received comments back from the various states by mid-July. During the interim, we contracted the North Central Computer Institute (NCCI) at Madison, Wisconsin, to determine if funds could be made available for the development of regional data requirements, or the definition of regional data sets. John Schmidt, Director of NCCI, indicated that the Institute, could cooperate by gathering groups for the purpose of focusing on regional data requirements and data sets, providing the meeting and budget were approved by the Institute's Board of Directors.

In early September 1982 the RCCO communicated with those people who expressed interest in two of the three proposed research topics: integrated pest management and the soil moisture model. A meeting will be held in Chicago during the early part of 1983. Each participant was asked to specify in writing their project objectives, task, specific contribution by individuals, and a rough budget. This contribution was to be received by the RCCO by 15 November to assemble the contributions from each State Climate Center, and to evaluate how that contribution will fit the overall objectives. It is

anticipated that after the meeting rough drafts of proposals will have been written; certainly the objectives, tasks, budget, and major statements will be in draft form for the discussion portion of the proposal including references.

#### LIAISON WITH GROUPS AND AGENCIES

RCCO is the primary liaison with the State Climate Centers, groups and agencies within the region and outside the region. During the first year of RCCO it was imperative that visibility be achieved with a variety of federal, state, and regional groups. The visibility was obtained in a variety of ways. Initial contact was often made by telephone and followed by a mailing. In some instances it was necessary after initial contact to go to the agency or group of agencies and brief the group about the RCCO and the climate plan adopted by NC-94. In addition, a newsletter, RCCO News, was established and announcements of the formation of RCCO and the NC-94 plan were forwarded to various professional groups. These releases have resulted in a large number of additional contacts being made with individuals within groups or larger groups wanting to know more about RCCO and the NC-94 Climate Plan.

A detailed listing of the various interactions on a state, federal, regional or national level which were made during the first year are given in Table 2. In summary it can be said that the RCCO visited the 12 State Climate Centers in the North Central region; contacted and briefed 16 Federal agencies and their major divisions; worked with or contacted 7 regional groups, both inside and outside the North Central region; and interacted with 3 State Climate Centers outside the North Central region. In addition,

Table 2. Contacts and Interactions of RCCO with Other Organizations in First Year.

State

- Visited all State Climate Centers.
- Begun collection of State Climate Plan.
- Encouraged and helped develop State Climate Plans in those states without completed plans.
- Briefed many campus leaders in North Central states.
- Interacted with states involved in climatic services and research.
- Briefed Office of Appropriate Technology (California).
- Briefed Tennessee Climate Center.
- Briefed Colorado and Kentucky Climate Centers about the Central Region Data Acquisition System.

Federal

- Contacted and briefed:
  - A. Office of Global Monitoring for Climatic Change (ERL).
  - B. World Data Center A for Glaciology (Cooperative Institute for Research in Environmental Sciences).
  - C. State Forecast Centers.
  - D. Midwest Agricultural Weather Service Center, West Lafayette, IN.
  - E. Center for Environmental Assessment Services (Columbia, MO).
  - F. National Center for Atmospheric Research.
  - G. USDA regional research centers.
  - H. Department of Energy.
  - I. U.S. Department of Agriculture.

INTERACTIONS (cont'd)

- J. National Science Foundation.
- K. National Oceanic and Atmospheric Administration.
- L. Climate Analysis Center.
- M. National Climatic Center.
- N. NWS Central Region Headquarters.
- O. NWS Eastern Region Headquarters.
- P. Sea Grant Program (Madison, Wisconsin).
- Q. National Climate Program Office.
- Contacted Environmental Data Information Service about possible data clearinghouse interactions.
- Interacted with NWS Central Region Office about Touch-Tone system for River Forecast Centers.
- Interacted with EDIS on NEDRIS Questionnaires.

Regional or National

- Worked with NC-94 Committee to establish a uniform, regional computer system.
- Interacted with North Central Regional Integrated Pest Management committee.
- Briefed NC-94 Committee on planned activities of Regional Climate Coordinating Office.
- Briefed North Central Directors of Cooperative Extension Service and Experiment Stations.
- Interacted with regional evaporation and transpiration subcommittee.
- Established contact and briefed North Central Computer Institute, and obtained help in the development and dissemination of regional climate data bases.
- Briefed Office of Appropriate Technology (California).

INTERACTIONS (cont'd)

- Briefed American Association of State Climatologists (AASC).
- Maintain contact with Northeast Regional Climate Center.
- Established contact with group trying to form a Southern Region Climate Office.
- Met with American Planning Association.
- Briefed Northeast Illinois Planning Commission.

General

- Established Newsletter.
- Article in State Climatologist.
- Project announcements to Weather & Climate Report, AMS Newsletter, Bulletin American Meteorological Society, EOS, and National Hazards Observer.

announcements of the RCCO and NC-94 Climate Plan were printed in at least 5 different national publications. Overall, the RCCO and the NC-94 Climate Plan have received good visibility within and outside the region.

#### BASIC PHILOSOPHIES AND EFFICIENCY OF RCCO

As RCCO evolved from the basic framework conceived and designed by the NC-94 committee in 1980-81, it has become evident that the RCCO must maintain certain perspectives and goals. The RCCO must be prepared through its liaison work with regional, national, and state organizations to reach out and help formulate those ideas which are permeating the various groups and to consolidate these ideas into working plans. These working plans must be designed to increase the efficiency of both the State Climate Centers and the other organization. The RCCO through its unique position of hearing both sides of the story must try to mold concepts so that they best dovetail with the objectives and goals of the State Climate Centers. A regional climate office must remember that it should be attempting to improve the facilities and increase the efficiency of State Climate Centers.

The regional climate offices become a clearing house of not only data, but of ideas, concepts, and plans. In addition, a regional climate center must be ready to fill the coordination void that has been left by the federal withdrawal from the State Climatologist program in 1973. Therefore, the region must be sufficiently large and diverse so as to encompass a large range of ideas and needs for service, research, and data acquisition. If the region becomes too small, the region loses its impact with larger groups, and subsequently, the regional reactions will be discounted. If the regions become

smaller, and as regions would proliferate it would be necessary to coordinate with more and more regional groups because of the various climatic episodes which would go beyond the state boundaries. As the episodes extend into other regions there would be a greater diversity of views, communication facilities, and data requirements, and it would become much harder to coordinate research, climatic outlooks, recent events, or recent episodes with other State Climate Centers.

The ability to work with a single group in a region is almost a necessity. If a single group with similar objectives and needs cannot be found, the task of the regional climate office would be fragmented and hard to control, especially in the early stages of a regional office. However, the common thread that is so essential to maintaining a unified set of goals and objectives can keep the overall goals and objectives too narrow because of a lack of ability to contact groups interested in other disciplines within the region, which also heavily impact the regional climatic resources.

Another major finding after a year of activity is that it takes time for a new institutional entity like RCCO to become known to the many university, state, and federal staff who could use our services. It will take time before the diverse users consciously think to call us for assistance. This argues that the Regional Office must be present for a sufficiently long time to become both visible and credible as a facilitating entity.

#### BUDGET DISCUSSION

During the year from 1 September 1981 to 30 August 1982, RCCO was granted \$61,708 by the NCPO. This was the operating budget along with the State of Illinois contribution of \$33,751 in salary and other line items for the support of this work. During its first year the NCPO funds helped

pay salaries of John Vogel, Edna Anderson, and Monica Cheng. Ms. Cheng was hired for 50% time during 1 month to copy hourly precipitation tapes for the U.S., which is now a major data resource for the region. The biggest other expenditure during the first year was that of travel which amounted to \$10,933. This was over the anticipated travel budget due to a line-item reduction of \$1,000 by the NCPO Office and an under estimation of the amount of travel that would be required. A detailed breakdown of the various line items during the year is presented in Appendix A.

#### REGIONAL TASKS FOR SECOND YEAR OF RCCO

During the coming year, the RCCO will continue to perform all of the tasks with which it has been charged in the Regional Climate Plan and in the project designed by the NC-94 group. We propose to concentrate specifically on two of the four tasks. These tasks are: 1) the design and initiation of a system for the near real-time collection of climatic data for each state, and 2) the development of a major regional research proposal.

One of the major services that can be provided by State Climate Centers is the dissemination of current climatic data and analysis. Many users of climate data need to know the current or recent conditions (accumulated growing or heating degree days, summer moisture to date, etc.) and to have climatic outlooks, if available. RCCO has been working with National Climate Program Office and the National Weather Service (NWS) to develop a linkage and access mechanism to a new data transfer system being implemented in the Central Region of the NWS. Daily rain and temperature data from cooperative observers will be transmitted by an encoder system to central microcomputers.

As this system's design is finalized, RCCO will work with the NWS to design the data network and the data collection desired by State Climate Centers. These data will be made available to each state so that updated climate data will be readily accessible in near real-time to users and for analysis. This would be a major breakthrough in most states, in that most do not receive the most recent cooperative observations until one to two months after the fact. In states where climate parameters, such as heating degree days or precipitation, are closely monitored, the current data acquisition system is too slow to be useful.

During the first year, the RCCO conducted a survey of the 12 North Central states to determine the most relevant regional research topics of interest to the states. The results from this survey indicated that a regional research proposal can best be developed from one of the following two topics.

- The development of a regional soil moisture model.
- Development of an integrated pest management model.

Responses are being solicited from the various states as to their participation in one of these research topics. Interested State Representatives will be brought together in a central location to discuss the development of a proposal for one or more of these regional research interests. It is hoped that the North Central Computer Institute will be able to provide funds to assemble the interested groups.

One of the activities during the second year is to encourage the establishment of Advisory Groups for each State Climate Center. The RCCO will be available for advice and to help develop guidelines for such State Advisory Groups. Members of the Advisory Group will vary according to user

needs and the structure of state government, but the Advisory Groups should consist of principle and potential users of climate data and information.

An important function of the RCCO and State Climate Centers is to be aware of various routine and special climatic data sets available from other agencies within the states. Utilities, sanitary districts, forestry services, and others monitor various climatic parameters on a routine basis. The availability of these parameters to users and their potential use for climatic impact studies should be known to each State Climate Center. During the coming year the RCCO will encourage and assist, when possible, the State Climate Centers to become aware of special climatic data bases that are available in their state. The RCCO will maintain an inventory of these data of regional interest. We will share those data of regional interest with the North Central Computer Institute (NCCI). One of the missions of the NCCI is to provide a vehicle for the development and dissemination of regional data bases. We will also cooperate with the development of the National Environmental Data Referral Service, by acting as a regional contact and by coordinating the collection of data peculiar to the region.

The success of any new concept such as RCCO hinges on the successful completion of objectives, and broadening the potential user groups. RCCO will continue to be the liaison with the State Climate Centers, regional groups, and federal agencies within and outside the region. The newsletter, RCCO NEWS, which was established in the past year will be continued. For some states, visits will be necessary to enhance the potential for attaining the minimal level of support within the State Climate Center. Another objective of visits within states this year will be to contact groups sensitive to climate, in addition to agricultural. Specific attention will

be paid to groups interested in the field of water resources. Visits with federal and private agencies to promote cooperation, communications, and regional research will continue. It is envisioned that considerable travel will be required. Continued contact with the various groups will also be maintained through correspondence and telephone conversations.

#### REFERENCE

Owens, R. W., 1977: Users Guide to the Kansas Agricultural Stations Weather Data Library. Dept. of Physics, Kansas State University, Manhattan, Kansas, 132 pp.

APPENDIX A

RCCO Budget

(1 September 1981 to 31 August 1982)

	<u>Budget</u>	<u>Actual</u>
Personnel	\$27,587	\$28,348
Fringe Benefit	4,617	3,342
Supplies	---	35
Publication/Printing	600	403
Travel	10,000	10,933
Mailing	300	64
Telecommunication	1,500	1,007
Indirect Costs	<u>17,104</u>	<u>17,576</u>
TOTAL	\$61,708	\$61,708