

**REPORT ON THE FIRST-YEAR ACTIVITIES AND ACHIEVEMENTS
OF CLIMAS**

February 1, 1998 to January 31, 1999

The Year in Review

Calendar of Achievements and Activities

Year 1 Research Agendas

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THE YEAR IN REVIEW

The 1998-1999 funding cycle for CLIMAS was characterized by intensive organizational activities required to set up both the core office and the research functions of the project. Also important were several key research initiatives designed to provide a solid foundation for subsequent research and outreach activities. Public relations activities were emphasized, with the goal of establishing a public presence for CLIMAS. Core office participation in an array of professional meetings, conferences, and workshops served to affirm CLIMAS within the research community. These topics are discussed in detail below.

The Year in Research

Research activities began in spring, 1998 with design and implementation of a pilot survey of stakeholders. This activity, directed and carried out through the Bureau of Applied Research in Anthropology, was financed with funding provided out of the CLIMAS core office budget. Input to the design of the project was provided by the CLIMAS program manager, the PIs, and members of the research team.

A review of newspaper accounts of significant climate events was underwritten by a portion of the core office budget advance to BARA, and a database to be used for cataloging and referencing these articles was developed.

During Spring, 1998, five research teams were formed and an agenda for work to be accomplished by each of the teams was developed. The core office was a key participant in development of the social science research agendas. Copies of these agendas are attached to this report.

By June, planning was underway for a forecasting workshop. This workshop, held in early July, was financed by the core office as was the summer pay of the Research Assistant who organized and ran the workshop.

A considerable amount of preliminary research and contact-building was undertaken for the Benson case study over the course of the summer. The core office was actively involved in reviewing these activities and in two key public contact efforts described in more detail later in this report.

The core office has been most actively involved in the urban water study. The program manager is directing the day-to-day research activities of this project. Summer activities had focused on a preliminary literature review and gathering of key sources for the core office archives. Since early fall, the urban water team, in concert with the full social science research team, has been involved in an intensive background research effort to develop important contextual information for the Southwest Region. Building on the information gathered from the literature review and contextualization process, the urban water team has now shifted to working on a preliminary sensitivity analysis of the urban water sector to climate variability. A draft of this preliminary analysis will be available for review and discussion in December.

The core office advised the ranching team on development of a research plan for the first year, and assisted the team in identifying two undergraduate interns from Columbia/Biosphere 2 to assist in gathering basic data. The team has begun the very large task of gathering important ownership and allotment data from archival sources such as Bureau of Land Management and State Land Office files. The core office remains in contact with the ranching team to offer assistance and consultation where needed.

The core office also designed a special user survey and placed it on the Web in August 1998. The survey, developed in collaboration with stakeholders at the Tucson National Weather Service Office, was designed to allow users to evaluate the Convective Outlook web pages provided by the Tucson NWS office. The core office analyzed the data, and wrote a report on the outcome of this survey. This report will be available on the CLIMAS web site in December. It is anticipated that this survey will be repeated next summer.

The narrative below discusses each of the CLIMAS year 1 research and outreach areas in greater detail.

Stakeholder Report

Beginning in the spring, the CLIMAS team designed and administered a survey to gather information about stakeholders' use of, and need for, climate information. A matrix was developed for use in identifying the categories within which the interviews would be distributed. All together, 71 individuals were interviewed, more than 60 of whom were identified through the matrix method. The remainder comprised initial test interviews and miscellaneous interviews deemed important in their own right. A copy of the survey instrument and of the matrix is provided in the Stakeholder Report. Interviews continued over the spring and summer of 1998, followed by analysis of the data in the fall. The Stakeholder Survey Report, after review by the CLIMAS Program Manager and by the PIs, is currently being readied for public distribution.

Findings of the pilot survey were grouped into four categories: climate and job responsibility, gaps in climate information, climate data collected by stakeholders and core office interactions. With regard to the relationships between climate impacts and job responsibility, the survey revealed that wide variation exists among respondents. Many users, especially those living in smaller towns, do not have sufficient infrastructural and financial support to devote much energy to the implications of climate for their area of responsibility. On the other hand, people with certain types of responsibilities, such as emergency response, make extensive use of forecasts, particularly short-term weather forecasts. Emergency managers in larger cities such as Tucson have the expertise and infrastructure to make extensive use of both weather and climate information; managers in small towns, by contrast, rely almost exclusively on weather information which is typically provided by county government or forecasters in larger communities. Of the land managers interviewed, only the three rangeland managers interviewed made extensive use of climate information to monitor and cope with conditions. They

expressed an interest in historic, current and predictive climate information. Park managers, developers, urban land managers, water providers, and public officials (with the exception of one individual) tended not to see a direct connection between climate and their occupational responsibilities. By contrast, the two individuals employed by utilities indicated that their organizations had a strong interest in climate information.

Gaps in current climate information systems is a category that encompasses areas where stakeholders indicated that information does not exist, is not known to exist (even though it actually does), is not available in useful forms, or requires special interpretive skills that the stakeholders lack. The survey found that, generally speaking, stakeholders who rely on conventional, tightly packaged sources (such as television, radio, newspaper) believed the information they were acquiring was adequate. On the other hand, some stakeholders expressed an unmet need for more complex information, including richer sources of historic climate data. The most prominent information gap, however, was found to involve the spatial scale of available data. Stakeholders cited the high spatial variability of climate in the region and the prevalence of very localized microclimates as conditions requiring more spatially specific information than is ordinarily available. The survey also discovered that information emanating from weather offices in the larger urban areas was seen by stakeholders in non-urban areas to be unuseful, while the lack of local weather stations and offices has meant that localized information is simply not available.

Findings regarding the collection of climate data by stakeholders revealed that about half of the seventy-one stakeholders surveyed collect such data, primarily on precipitation and temperature. Many also collect data specific to their occupations such as depth to groundwater. For the most part (except through the weather data collection cooperative efforts such as that conducted by the National Weather Service), these collection activities are informal, and were not deemed by the research team to be verifiable in terms of accuracy or consistency.

Stakeholders were asked to indicate whether a core office offering climate services would be useful to them, and if so, what sorts of access they would like to have. The most frequently cited modes of access were Internet and telephone (tied) followed by newsletter. Many of those preferring telephone access simply wanted a point for obtaining referrals to the proper organizations, some specific form of data, or answers to specific questions. A few wished to be able to obtain current reports on weather conditions throughout the state. Twenty-five percent of respondents expressed an interest in participating in a workshop appropriate to their needs. Among the most frequently cited workshop topics was assistance in finding climate information from different sources as well as interpreting and applying the information. A smaller proportion expressed an interest in learning about the accuracy of forecasts. Two wanted information on how forecasts from urban centers can be effectively applied to their small-town localities.

An analysis of patterns of climate use by occupation reveals which entities are frequent users of “basic” (i.e., local TV station weather reports, etc.) or “complex” information, and who are infrequent users of these types of information:

Type of user	Users of complex information	User of basic information
Frequent	Emergency managers (large community) Water Providers Farmers	Emergency managers (small town) Utilities Farmers
Infrequent	Rangeland managers	Water providers Public officials Land managers of other than rangelands

Analysis of the interviews in terms of interest in short-term versus long-term data revealed that a range of timescales was needed ranging from paleoclimatic records to real-time forecasts and both short- and long-term forecasting. Most interviewees indicated they often make decisions based on weekly forecasts; the short-term forecasts currently available are satisfactory to their needs. Unmet needs identified in the survey include better tracking and forecasting of convective storm cells during the summer monsoon season. Thirty-day forecasts are particularly needed by farmers, as is historical information on historic average start dates of summer monsoons.

Survey findings suggested several areas of constraint with regard to the use of climate information. These constraints include lack of perception of the importance of climatic impacts, particularly potential areas of significant vulnerability that could be eliminated or mitigated through use of climate information. Lack of appropriate decision-making capacity was identified in the survey as another constraint to using climate information. This situation is seen as constraining individuals from responding to forecasts or events in a meaningful way. Findings also indicated that perceptions of climate and of climate information play an integral role in determining whether stakeholders incorporate climate information into their planning and decision making processes. Fatalism about climate and lack of faith in the accuracy of forecasts were identified as being among the important intervening factors in this context. Other intervening factors identified included political realities, and demographics and related demand pressures.

Among other important findings of the stakeholder pilot survey was affirmation that the survey methodology and instrument were generally valid for the purposes intended. This was a key goal of the pilot survey. With some modification of the survey instrument and methodology, the pilot survey will be replicated over the course of the Year 1 social science research activities: as researchers go out in the field to conduct the urban water, ranching, and community studies, a point will be made of including key stakeholder questions about the need for and use of climate information of various types. These data

will be added to the existing stakeholder data base and will be used for subsequent core office outreach efforts.

Recommendations emerging from the study focused on reinforcing the role of the core office in responding to expressed stakeholder needs for climate information and the importance of carefully identifying whom the project will serve. Other recommendations focused on the need for identifying vulnerable stakeholders, and initiating more vulnerability research projects that look at climate impacts on those those who do—and those who do not—use climate information in their decisions and actions. In addition, the study noted that stakeholder survey research needs to be broadened to include federal and state agencies, as well as to other communities.

Newspaper Review

The review of Tucson and Phoenix newspapers, initiated in spring, 1998 with core office financial support, was designed to provide a view of how the impacts of unusual climate events were portrayed in popular media. The exercise allows for identification of important incidents as well as useful anecdotes about climate and its impacts on individuals, communities, and sectors. It also provides suggestions of areas where further research would be productive (for example, the effects of flood events on urban water supply delivery systems). Information about the articles (title, date, source, keywords) are being archived on a computer database which is available for use by all CLIMAS team members. Hard copies of key articles are also archived for use by team members. Work on this project continues with the assistance of the BARA research team.

Forecasting Workshop and White Paper

The core office sponsored and funded a forecasting workshop on July 8 and 9, 1998. Participants were primarily agency personnel who are involved in operational forecasting activities such as issuing forecasts, providing data for making forecasts, or serving as liaison for communicating forecasts. In addition to providing a considerable amount of useful information about forecasting, the workshop produced several key contacts for ongoing interactions regarding forecast products, techniques, and evaluations. Roger Bales and Holly Hartmann, the organizers of the workshop, were subsequently invited to attend a meeting in Salt Lake City of the river forecasting group. Roger Bales gave a presentation on CLIMAS at this meeting; he and Holly Hartmann also discussed possibilities for further cooperation between the River Forecast Center and CLIMAS.

The workshop and subsequent white paper research generated some key findings. First, there are clear contrasts between hydrologic and weather/climate forecasting. The state of meteorologic forecasting features rapid incorporation of a wide variety of research findings and products. Experimental forecasts are routinely issued. Operational forecasts can be adjusted based on recent climate diagnoses and improved conceptual understanding of linkages between ocean and atmospheric dynamics. Different forecasting techniques may prevail in different regions, over the course of different seasons, and for unusual conditions. Further, meteorologic forecasting has a strong history of forecast quality assessment. By contrast, hydrologic forecasting has been characterized by much slower evolution, with constraints imposed by complex data

management systems, long-standing operating procedures, and an institutional preference for operational uniformity. In addition, quality evaluation of operational products is uncommon. Even coordinated comparisons of hydrologic model performance have been infrequent and often contentious.

A question considered at the workshop was the advisability of using historical forecast archives for decision making. In this case, the consensus was that it is acceptable to use the archives for this purpose, and in fact may be more realistic for vulnerability assessments than relying on reanalysis studies. Reanalysis, on the other hand is particularly useful for evaluating the skill of forecasting methods, while it is not good for assessing socioeconomically or hydrologically based decisions.

On the social science research side, workshop participants recommended that analysis of stakeholder decisions that were made in the past be done to identify evidence of use of climate forecasts in making those decisions.

In terms recommendations related to the evaluation of the forecasts themselves, a series of recommendations were identified and prioritized at the workshop. "Priority One" recommendations included evaluation of CPC one- and three-month temperature and precipitation outlooks, and evaluation of water supply outlooks in terms of coordinated seasonal volumes. Among the "Priority Two" recommendations for forecast evaluation were reanalysis of water supply outlooks with regard to seasonal volumes and hydrographs from ESP forecast procedures; reanalysis of water supply outlooks in terms of seasonal volumes and hydrographs emerging from statistical forecast procedures; and evaluation of gridded precipitation and snow estimates to be used in forthcoming distributed forecast procedures.

In the realm of modeling, recommendations focused on incorporation of climate outlooks into statistical water supply outlook techniques as "Priority One" activities. Improvement of conceptual distributed hydrologic modeling capabilities was given a "Priority Three" ranking.

Recommendations for improvement of forecast products and communications included two items, both of which were given a "Priority One" ranking: development of location-specific climate outlook products, and development of improved hydrologic forecast products. It is important to note here that the stakeholder pilot survey indicated that the availability of forecasts for the time period of one week to one month out were important. Although recognizing that this is a particularly difficult area for developing forecasts, the core office believes that this recommendation should be pursued to the extent possible given existing scientific and technical constraints.

Climate Research and History Database/White Paper

A separate natural science team has been working since late last summer on developing a metadata base and white paper that catalogue and describe what is currently known about climate and climate processes in the Southwest. Paleo and historical times are being covered by this project. The initial white paper will be available for review in December.

The final report and database will be available in the spring. Core office interactions with this team have included working closely with Kurt Angersbach, who wrote the climate chapter for the context white paper. Other interactions have included contacting team members to obtain needed historical and paleo information for the urban water study, and requesting status reports on the team's progress. It is anticipated that the work produced by this team will be key for ongoing research efforts and outreach efforts.

Benson Case Study

Work on the Benson case study has included substantial preliminary contact with local entities ranging from political figures to educators, private business people, a health care provider, among others. Also, intensive work has been done by the Core Office RA in developing a solid information base about hydrology and water resources in the upper and middle San Pedro. This work has been done as an assignment over and above the general core office duties assigned to this individual. A presentation on CLIMAS and on the proposed integrated community study was given to the Benson Town Council in August; the council voted to support the project, which the team considers to be a significant positive development. The Program Manager gave this presentation; others in attendance that evening included Malcolm Hughes, Tim Finan, and RA Nick Benequista. A second presentation was given to the Benson Economic Development Committee, to which many of the most influential people in town belong. Tim Finan gave the presentation, supported by the core office program manager and RA Petra Tschakert. The economic development group also expressed support for the project.

As detailed below, this preliminary work was followed by an intensive effort on the part of the entire social science team to compile contextual information about Arizona and New Mexico. This exercise has considerable value in setting the framework within which the ethnographic study and analysis will be conducted. Field work in Benson is scheduled to begin in January 1999. A detailed task plan for undertaking the field work has been drafted and is currently under review by the social science team.

Urban Water Study

As noted above, the urban water study is being directed by the CLIMAS program manager. Work on the urban water study has included review and compilation of a considerable collection of literature on water and climate in the Southwest, particularly in the designated study areas. The literature review facilitated design of the sensitivity analysis itself and provides an important foundation for the workshop on policy issues and the survey to be undertaken after the first of the year. The sensitivity analysis is currently underway, and preliminary results in the form of a white paper will be available in mid-December. Compilation of background information on water supply and demand in Arizona and New Mexico has been completed, and forms a section of the context paper described below. Contacts have been established with the policy specialist at Tucson Water Company, and with key information specialists in the Arizona Department of Water Resources Tucson, Phoenix, and Nogales Active Management Area offices. Stakeholder contacts will also be initiated in the near future with water companies in Prescott, Albuquerque, Benson, and the greater Phoenix area.

Context White Paper

In Fall, 1998, the Social Science team determined that establishing a suite of climate-related contextual factors was crucial to carrying out the urban water study, integrated case study, and ranching study. The social science RAs gathered background information on land use, agriculture, sociodemographics, economics, local climate, water resources, and policies important to climate-related decision making and actions. The information was compiled into a white paper designed for use by CLIMAS researchers. This research has utility for stakeholders as well, so a version of the white paper will be maintained for public use on the CLIMAS web site. Supporting, detailed data will be maintained in spreadsheet and/or GIS format and made available.

Ranching Study

The core office has been available to assist the ranching team and has endeavored to ensure that team members are linked with individuals who could be useful to the project. For example, the core office arranged for the ranching project director, Tom Sheridan, to meet with UA researchers who are attempting to establish an interactive website to be used by rangeland managers. Climate information is a key element in the development of this website, and there is strong interest in ensuring that the web site is of maximum use to all those who are engaged in ranching and in rangeland management more generally. Likewise, the ranching team was introduced by the program manager to an individual who has been producing forecasts for ranchers for the past twenty years.

The ranching team is currently gathering important foundational information, including ownership data, allotment leases, and price trends. These data are crucial to setting the groundwork for the second phase of the project, which involves interviewing individual ranchers. This part of the project will be initiated after the first of the year. Tom Sheridan has solid ties with the ranching community, as does team researcher Diana Hadley; these individuals will be key to drawing ranchers into the project, including obtaining their participation and support.

THE YEAR AT THE CORE OFFICE

SUMMARY

The core office began its existence with a transfer in February 1998 of \$15,592 in funds to the Bureau of Applied Research in Anthropology (BARA) to be used to undertake an initial survey of stakeholders in the Southwest Region and to begin collecting background information from newspaper sources about the impacts of key climate events on Arizona communities. The Stakeholder Survey Report is now under final review by the project PI's and will be available in hard copy and on the CLIMAS web site by December, 1998.

Barbara Morehouse, Program Manager for CLIMAS, was hired at the beginning of March, 1998 and has served since that time in multiple capacities:

- establishing outreach mechanisms to connect the project with stakeholders in the region,
- coordinating the various research projects being carried out under the first year's research funding,
- facilitating the integration of the social and natural scientists into a single team,
- managing the project budget
- contributing to the social science research effort
- fostering and maintaining linkages with other research groups
- facilitating integration of the urban water studies and ranching studies into the USGCRP regional assessment
- communicating information about the project and its activities in professional and public venues

Major accomplishments achieved since inception of CLIMAS in February 1998 include:

- CLIMAS web site (<http://www.ispe.arizona.edu/swclimate>)
- *CLIMAS Update* newsletter
- Weekly meetings for the full CLIMAS group, usually featuring a guest speaker
- Biweekly meetings for the social science team members
- Report on initial stakeholder survey
- Forecasting workshop
- Contextualization of the Arizona-New Mexico region
- Preliminary outreach to Benson for integrated case study
- Arizona Convective Outlook online user survey and report
- Briefing session for stakeholders
- Presentations at numerous professional meetings
- Participation in California and Native Peoples USGCRP workshops

The Year at the Core Office in Detail

The core office was initiated in February, 1998. Barbara Morehouse, Program Manager, assumed responsibility for management of the CLIMAS core office and project on March 9, 1998. Since March, 1998, the core office has been engaged in a wide range of activities. These activities have been categorized, and each of the categories is discussed in detail below.

Team Meetings

The core office initiated weekly team meetings in March, 1998. These meetings, which continue to be held on a weekly basis, are scheduled to maximize participation by CLIMAS team members. All meetings except PI meetings are open to outside attendance, and typically at least two or three people external to the project attend. Most meetings feature a guest speaker; time is also scheduled for team members to give presentations on their research and other pertinent activities.

Meetings with Outside Visitors

Between March and December, 1998, core office hosted several individuals from outside the Tucson area. John Roads was a guest of ISPE and CLIMAS in October, in conjunction with the PACs meeting. Barbara Morehouse, Bill Sprigg, and Andrew Comrie met with him to discuss coordinating the forecasts provided through Scripps with the work being done through CLIMAS and other more general ISPE global change activities. Also visiting ISPE and CLIMAS at that same time was Andrea Ray, who organized the PACS conference. Interactions with Andrea provided important clarification on the ways in which the PACS program wished to initiate interactions with the Southwest Assessment. Ruben Lara, from Baja California visited the CLIMAS office in October, also in conjunction with the PACS meeting. In late October, Phil Mote met with the CLIMAS team and gave a presentation on work being done by the PacNW project, especially research on the Pacific Decadal Oscillation. He also met separately with Barbara Morehouse, Bill Sprigg, and Roger Bales to discuss the USGCRP regional assessment process.

Monitoring Progress and Facilitation of Team Communications

The core office maintains regular contacts with the various researchers to monitor progress toward milestones and deliverables. This is typically done through requests for progress reports at PI and CLIMAS team meetings, as well as through communication by telephone and email. The Program Manager also reviews and provides comments on drafts of reports and white papers.

With regard to communications, The core office established a web site in the spring of 1998; a restricted team site was subsequently added to the web. This site requires knowledge of a userid and password to gain entry. Notes of team meetings are posted on this site, as are documents being sent out for review and other items.

The core office also set up two listservs to facilitate communications between the office and team members, and among team members themselves. The larger listserv encompasses a long list of individuals (both local and nonlocal) who have expressed an interest in remaining informed about CLIMAS. Some stakeholders are included on this list, including representatives of the National Weather Service office in Tucson, the Arizona state climatologist, and representatives of Arizona State Emergency Management. A smaller listserv serves the social science team. Announcements of upcoming meetings, and a variety of other types of information are sent out over the listservs regularly.

Participation in Outside Events

Participation in conferences, workshops, and other events is key to building networks with other research units, individual researchers, governmental organizations, and the general public. A complete list of core office activities is provided at the end of this report. As examples of participation in outside events, CLIMAS members have met with the Tucson Stormwater Management Committee (Diane Austin, Holly Hartmann, Barbara Morehouse) and with the Benson City Council (Barbara Morehouse, Tim Finan, Malcolm Hughes and Nick Benequista) and the Benson Economic Development Committee (Tim Finan, Barbara Morehouse, Petra Tschakert). The Program manager gave talks at a meeting of the Arizona Environmental Technology Industry Cluster (the Program Manager has since accepted an invitation to join the board of this group), as well as at an Integrated Assessment Workshop, the PACS PI meeting (with Tim Finan), the Arizona Association of Civil Engineers meeting (with Roger Bales), the National Weather Service conference, and the UA Department of Soil, Water and Environmental Science. A meeting of USGS hydrologists at the ISPE offices in November provided yet another opportunity for discussing the project. The Program Manager gave an update on CLIMAS work at this meeting and RA Petra Tschakert participated in the meeting as an auditor.

The Program Manager also participated in/attended a NASA remote sensing conference in Tucson and global warming meetings in Tucson and Phoenix, as well as USGCRP global change workshops in Santa Barbara and Albuquerque. These meetings and others provided excellent opportunities for discussing CLIMAS with interested individuals who were attending the events, and also provided opportunities to acquire new information, knowledge, citations to relevant research publications, and learn how others pursue activities similar to those of the CLIMAS core office.

Roger Bales has represented CLIMAS extensively over the course of the past year, both within and outside the University of Arizona. For example, he was instrumental in ensuring that CLIMAS was linked to the RESAC proposal submitted to and funded by NASA. More generally, he has worked to integrate CLIMAS within the larger ISPE global change program. He participated in the Santa Barbara and El Paso climate change workshops, and has been chairing the steering committee for the USGCRP Southwest Regional Assessment. He gave a talk on CLIMAS to the Arizona chapter of the American Society of Civil Engineers in Phoenix, as well as a presentation on the project to the Salt lake City river forecasting group meeting. Bill Sprigg, ISPE deputy director,

has also given talks on CLIMAS and its research activities, particularly in the contexts of the national assessment process and his work to initiate a climate and health research program at ISPE.

Although not necessarily funded by NOAA, individuals associated with CLIMAS have been engaged in a number of other activities that have either directly or indirectly supported CLIMAS. For example, the Udall Center published the final report from the 1997 Climate Change workshop held in Tucson; Bob Merideth is currently working on a stakeholder-oriented climate change primer based on this report. Diana Liverman gave talks about the Southwest regional assessment at a NASA land use PI meeting in April, at a border conference that same month, and at a UTEP meeting in El Paso. She gave guest lectures at ASU, NMSU, and the University of Minnesota. She also wrote a section on regional assessment for the Committee on Global Change Pathways report. This report was published late last month. In addition, she met in Miami, on October, with the regional assessment team for the Southeast assessment.

Malcolm Hughes and Soroosh Sorooshian regularly participate on committees and in meetings and conferences related to regional assessments.

As described above, other activities have included building linkages with the UA AgNIC program with regard to cooperating in the development of climate information for a web-based rangeland management information system. This effort has included integrating Tom Sheridan and the ranching vulnerability, as well as the core office, into the AgNIC group. Linkages have also been initiated with the ARIA project, which seeks to build an archive of digital images of Arizona. In this case, the intent is to ensure ongoing cooperation in the generation and use of such images. Likewise, the core office has sought to maintain linkages with the Arizona State climatologist, located in Tempe at Arizona State University, and with Biosphere 2 through Dale Rothman, who is a global change researcher, economist, and faculty member at the Biosphere. With the additional charge of folding the CLIMAS urban water and ranching studies into the USGCRP regional assessment, linkages have also been forged with two key individuals in New Mexico: Janie Chermak, an economist at the University of New Mexico and Laura Huenneke, a plant ecologist at New Mexico State University.

Public Relations

An important early outreach effort undertaken by the core office was design and installation of the CLIMAS public web site. The site provides links to important climate information and forecast sites, details the mission, goals, and activities of the CLIMAS project, and provides other types of information, including research findings, news items, etc.

The core office designed an attractive printed brochure that describes CLIMAS, its mission, and the key players. This brochure has been invaluable for getting the word out about the project. It is distributed wherever members of the team have been involved in giving talks or otherwise interacting with potentially interested entities.

In addition to the web site and brochure, the core office has initiated publication of a quarterly newsletter, the *CLIMAS Update*. The first newsletter was published in August/September. The second issue is slated for distribution and loading on the web site in early December. This newsletter is sent to a list of recipients derived from a global change database managed by the Udall Center for Studies in Public Policy. The basic list provided by the Udall Center is augmented with a list of individuals identified during the course of the research and core office outreach activities. It is anticipated that, as specific types of climate information about the Southwest are verified and made available by CLIMAS researchers, the information will be passed on to stakeholders through the newsletter and the CLIMAS web site.

Among other public relations activities, the Program Manager gave a radio interview in June, which was played over public broadcasting stations in the state, and a press release was sent out by UA immediately after another key outreach effort, the stakeholder and university community project briefing held by the core office in May. Barbara Morehouse co-authored an article with Bill Sprigg on CLIMAS and the regional assessment; this article appeared in the first issue of the USGCRP *Acclimations* newsletter.

Outreach Activities

As detailed above, a climate and hydrologic forecasting workshop, sponsored and funded by the core office, was held in July provided an opportunity for forecast professionals to meet and discuss the types of products they produce, how the forecasts are done, and what sorts of new technologies and products are emerging. Other topics included a discussion of who uses the forecasts and for what, and what the status is of evaluating the skill of the forecasts. An outgrowth of this workshop was an opportunity for Roger Bales and RA Holly Hartmann to participate in a hydrologic forecasting meeting held subsequently in Salt Lake City. This interaction is expected to continue and to grow in significance as the project unfolds.

Also described in detail above was the pilot stakeholder survey. Carried out over Spring and Summer, 1998 not only constituted an important outreach activity for CLIMAS, but also provided a framework for subsequent stakeholder outreach efforts. Key questions from the stakeholder survey will be replicated in interviews done for the urban water study, ranching study, and integrated case study. This will allow the CLIMAS team to augment the stakeholder database built from the pilot project, and to identify new individuals and organizations with whom the core office should maintain communications.

As noted above under "Communications," the core office has reached out to stakeholders via an array of venues ranging from individual interactions and small committee meetings to large conferences.

The results of the Year 1 research projects will provide important information and knowledge needed to begin to provide stakeholders with the climate information they need. For this reason, the core office maintains an active involvement in the research

component of the CLIMAS project, particularly on the social science side. The results of the social science research projects are expected to provide the core office with key information it needs to establish ongoing relations with the stakeholders involved in those projects.

Research Activities

The core office has been very active in the social science research projects throughout the first year of its existence. The Program Manager directs the work of two RAs, assists in the gathering and interpretation of data, sets task lists and timelines, and coordinates the study with the other CLIMAS research projects and teams. The Program Manager participates in biweekly meetings of the social science team and provides input to decisions on priorities, research activities, and deliverables. The Program Manager also works closely and regularly with the directors of the ranching and integrated case study to resolve issues, identify research assistants, and generally ensure that the projects are on track and in conformance with the research proposal approved by NOAA. While the Program Manager does not participate regularly in the activities of either of the two year 1 natural science projects, the core office makes a point of maintaining open communications with the PIs and RAs and facilitating interactions to ensure a smooth flow of information and assistance.

Educational Activities.

Educational activities have revolved around preparations to hold a graduate workshop in Spring 1999. The workshop, being co-taught by Barbara Morehouse and Stuart Marsh, is designed to provide students with an opportunity to work in an interdisciplinary context on a problem that has direct implications for a real-world constituency. The workshop for Spring 1999 will focus on a selected problem emerging from CLIMAS research. Currently, the intent is to focus on a problem related either to the urban water or the ranching study with the goal of producing one or several products that will be useful to one or more stakeholder groups. Students from both social and physical/natural sciences are being encouraged to sign up. The workshop will focus on a different topic each week, and will feature guest speakers who are expert in each topic. Although the actual format may change depending on the speaker's preferences, it is anticipated that the first part of each session will revolve around discussion of a particular category of data (such as ecosystem data, remote sensing data, socioeconomic data etc.), including the types of data available, sources, best uses, and caveats associated with their use. The second part of the session will be devoted to discussion and possibly an in-class exercise. The students will be required to identify the products they will produce by the end of the semester, to formulate a strategy for achieving their goals, and to work in an integrated, cross-disciplinary fashion in achieving the specified results.

Office Management

Establishing the core office, along with its procedures and daily operational routines, was an important element in managing the CLIMAS project and its budget. The issuing of offer letters and hiring of staff, installation of new hardware and software, initiation of budget management procedures, and general establishment of work hours, routines, and expectations were all important elements to establishing successful operation of the core

office. Coordinating budget-related activities between the subaccounts of the various PIs and the business office of Arizona Research Labs, which handles all business affairs for The Institute for the Study of Planet Earth, has been among the most important services extended to CLIMAS researchers by the core office.

Currently, the core office budget supports the Program Manager, one half-time RA, and one part-time computer assistant. An second half-time RA assigned to the water study and supported through one of the matching funds assistantships also works in the core office facility, as does an undergraduate assistant funded under the UA NASA Space Grant undergraduate intern program. This intern is also working on the urban water study.

With the office routine well established, and budget management procedures in place, the core office is now focusing on augmenting the CLIMAS web site, reinforcing networks built over the past year, participating in social science research activities, and identifying the best avenues for expanding stakeholder outreach activities.

Looking Ahead

As the CLIMAS core office moves into Year 2, it is appropriate to examine its future direction and responsibilities. Topics to be considered include research priorities, outreach agenda, USGCRP assessment process, staffing and equipment, networking, professional interactions, and products and publications.

Research Priorities

The core office will be working to acquire more knowledge about the climate information uses and needs of selected sectors in Arizona and New Mexico. Activities over the course of the first year of CLIMAS provided a foundation for identifying which sectors to target in the stakeholder survey. This activity should be extended in Year 2 to encompass one or more of the following sectors, including the related government agencies: health services, agriculture, tourism, Native Americans, emergency management.

The core office will continue to work on water supply/demand research, building on the research completed in Year 1. A preliminary outline of Year 2 research is included in the Year 2 NOAA research proposal. A more detailed description is being prepared and will be available in January 1999.

The core office will also encourage expansion of the integrated community assessment project to address at least one more community so that a beginning can be made in identifying similarities and differences in climate information needs in different parts of the region. If border research is funded in Year 2, a border community such as Nogales, Douglas, or Yuma/San Luis might be appropriate.

The core office plans to build on the USGCRP Native Peoples/Native Homelands workshop by establishing working relations with selected tribes in the region. It is anticipated that an early research effort will focus on assisting the Kaibab Paiutes in

developing a drought management plan. This effort will be directed by Diane Austin (BARA); the core office will provide administrative support for this project as needed. If, as anticipated, BARA undertakes a Native American research initiative in Year 2, the core office will endeavor to provide appropriate support as needed.

USGCRP Regional Assessment

With regard to the USGCRP regional and national assessment initiatives, the core office will be actively involved in the research activities associated with the assessment, and in development of the report for the Southwest Region. The intent is to establish an assessment framework which will facilitate ongoing assessment within the Southwest region, based on the USGCRP and IPCC frameworks.

Outreach Agenda

The core office plans to extend its outreach efforts to encompass regular participation in relevant public meetings and events, expansion of the *CLIMAS Update* newsletter to include climate history and forecast information, continued expansion of the mailing list for the newsletter and other materials, and expansion of the CLIMAS web site to provide information more closely tailored to conditions in the Southwest and to the needs of stakeholders. The core office will also sustain its vested interest in ensuring that stakeholders are as fully integrated as possible in CLIMAS research projects, and that their needs are identified with sufficient clarity to identify what climate services might be provided to meet those needs.

To this end, and based on the outcomes of the Year 1 research efforts, the core office will work with the urban water, ranching, and Benson communities to identify productive ongoing stakeholder outreach services. The core office also plans to sponsor at least one pilot workshops to train stakeholders from one or more of these studies in how to access, interpret, and evaluate climate information and forecasts that are most pertinent to their needs. These workshops will provide the core office with important insights into how best to design and conduct user education activities.

Office Management and Equipment/Supplies

The core office will continue to be managed by the program manager, with the assistance of two half-time RAs, part-time computer person, and some undergraduate student assistance as needed for special projects and activities. Help from the ISPE administrative assistant will also be required, as has been provided this past year. The addition of a second half-time RA is seen as necessary for developing and maintaining climate information pages and forecast sites on the CLIMAS web site, and assisting in the design and running of workshops to train people in how to use climate information. Equipment and supply needs will largely revolve around acquisition of software, office supplies, maps, books and subscriptions, and other such items. Setting up an archival/retrieval system for data produced by the project will be a priority.

Networking

Networking will continue to constitute an important part of the core office functions. The core office will maintain existing interactions with information providers, and other

scholars, and will seek to expand the network through connecting with individuals and organizations doing similar work in the United States and around the world. Identified opportunities exist for linking with similar projects in Australia, Mexico, and the European Union. Specific networking and integration items will be following up with the UA AgNIC group to add climate information to their rangelands site, administering the on-line convective outlook survey for the Tucson NWS office next summer to gather additional information on users and their evaluation of the site, and developing more formal relationships with climate researchers at Scripps, Desert Research Institute, and the Arizona State Climatologist's office. It is anticipated that CLIMAS will develop ongoing linkages with the RESAC project, which UA was just recently awarded by NASA, as well as with other climate-related projects at UA and at other research centers focused on the Southwest.

Professional Interactions

As with networking professional interactions, including participation in conferences, workshops, and other types of meetings is important to the success and dynamism of the project. Activities already identified for next year include presentations and a focus group session at the American Society of Civil Engineers Conference in June in Tempe, Arizona and presentations at the Association of American Geographers meeting in March in Honolulu. In addition, the Program Manager has been invited by Bill Riebsame to give a talk, in February, to his group at the University of Colorado-Boulder. A session at the Spring 1999 AGU session on climate assessments is being co-organized by Phil Mote of the Pacific Northwest Climate Project and Roger Bales. It is certain that other such opportunities will arise.

Products and Publications

The core office will be publishing the results of the Year 1 research next year in report form, and in the form of summarized products of more immediate interest to stakeholders. These products will be available in hardcopy and on the CLIMAS web site. The core office is investigating possibilities for collaborating with the UA's Udall Center on a book about climate in the Southwest. Publication of the *CLIMAS Update* newsletter will continue, with expansion to include news about climate and specific climate information. White papers and other publications will also be published through the core office, both in relation to CLIMAS research, and associated with the USGCRP regional assessment.

APPENDICES

CALENDAR OF CLIMAS ACTIVITIES AND ACHIEVEMENTS
February to December, 1998

Regular Events

Weekly: CLIMAS full team meetings

Biweekly: CLIMAS social science team meetings

Specifically Scheduled Events and Activities

March 9-12, 1998. Attended USGCRP California Global Change Workshop in Santa Barbara. Networked with many individuals and gathered a considerable amount of information and publications valuable to the CLIMAS effort.

April-May, 1998. Discussed CLIMAS with each candidate interviewed for position of Director of ISPE.

April-May, 1998. Interviewed each of the five PIs to obtain insight into their views about the functions of the core office and about the CLIMAS project more generally.

April 16, 1998. Interview with Glen Sampson and David Bright of the Tucson NWS office, to discuss the project and how they might like to be linked with it.

April 22, 1998. Participated in global warming teleconference in Tucson. Served as a facilitator for one of the discussion groups.

April 29, 1998. Interview with Dr. Katie Hirschboeck, of UA, whose research is very pertinent to the CLIMAS endeavor.

May 7, 1998. Hosted briefing and reception on CLIMAS for stakeholders and researchers. Members of the CLIMAS team gave presentations and discussed the project individually with attendees.

May 8, 1998. Participated in NASA meeting regarding building NASA data services to stakeholders. Discussed CLIMAS project with a variety of resource managers and other interested individuals.

May 12, 1998. Gave presentation on CLIMAS to the Arizona Environmental Technology Industry Cluster. Also giving a talk was Dr. Lisa Graumlich, Deputy Director of Columbia/Biosphere2.

May 21, 1998. Held meeting (also attended by RAs Rebecca Carter and Petra Tschakert) with Ann Phillips of the Tucson Active Management Area Office of the Arizona Department of Water Resources and Dennis Rule of Tucson Water Company to discuss their involvement in the Urban Water Study.

May 26, 1998. Did radio interview conducted by Jeff Harrison of UA News Services. The interview was broadcast on public radio stations around the state shortly thereafter.

June 12, 1998. Participated in meeting of AgNIC group to learn about their efforts to develop data bases and an interactive web site for rangelands managers. Gave presentation on the CLIMAS project to participants.

June 15, 1998. Had meeting with Dr. Robert Schowengerdt to identify ways to integrate CLIMAS with his ARIA project, which has as its goal providing digital images of Arizona to researchers.

June 17, 1998. Gave presentation on CLIMAS at NWS conference held at the Tucson NWS offices.

June 24, 1998. Participated in meeting of UA AgNIC group with goal of facilitating interactions between Tom Sheridan (directing the CLIMAS ranching study) and the AgNIC rangelands project; goal is to use the proposed AgNIC Rangelands website to provide more and better climate information to rangelands stakeholders.

June 30, 1998. Meeting with Ann Phillips of Arizona Department of Water Resources to discuss her potential participation in the Urban Water Study.

July 8 to 10, 1998. Participated in integrated assessment meeting in Washington, D.C., sponsored by the Association of American Geographers. This meeting provided an excellent opportunity to present CLIMAS to integrated assessment researchers and to network with others doing similar work.

July 15, 1998. Interview with Barbara Tellman, research specialist with the UA Water Resources Research Center (WRRC). Obtained information and publications useful to the project, and established link between CLIMAS and WRRC.

July 28, 1998. Attended El Niño postmortem meeting sponsored by Claudia Nierenberg and Katie Mastrianni in Santa Monica. Supported travel of RA Tom Pagano, who is writing his master's thesis in Hydrology & Water Resources on climate information use by Arizona stakeholders during the El Niño.

July 31, 1998. Interview with Robert Glennon, law professor at UA and expert on water law. Obtained important information for use in urban water study and established formal linkage with him, in anticipation of future collaboration.

August 17, 1998. Presentation to Benson Town Council.

August 20, 1998. Participated in Benson Economic Development Council meeting (T. Finan gave presentation)

September 9, 1998. Mailed first issue of CLIMAS newsletter.

September 16, 1998. Attended La Niña briefing held in Phoenix by National Weather Service.

September 24, 1998. Co-sponsored EPA Global Warming conference in Phoenix. Accepted invitation to have a table display, with literature on the project for participants to take with them

September 25, 1998. Invited presentation, American Society of Civil Engineers meeting in Phoenix, together with Roger Bales: "Southwest climate assessment project."

October 5, 1998. Held meeting with John Roads of Scripps, Andrew Comrie and Bill Sprigg to discuss potential avenues of cooperation..

October 6, 1998. Arranged meeting with John Roads of Scripps. Attending were Dr. Bill Sprigg, Deputy Director of ISPE, and CLIMAS team member Dr. Andrew Comrie of the UA Department of Geography. Discussion focused on use and evaluation of experimental forecasts produced by Scripps.

October 7, 1998. Invited presentations, Pan American Climate Studies conference in Tucson: Barbara Morehouse, "Building bridges between climate science and the public; Tim Finan, "The social science of climate: vulnerability assessment in the Southwest."

October 8, 1998. Meeting with Ruben Lara of Baja California. Discussed his interest in establishing an office similar to the CLIMAS core office for the northern Mexican border states, and how the two projects might establish a collaboration.

October 19, 1998. Gave a talk for the UA Department of Soil, Water and Environmental Science, "researching climate variability in the Southwest using an integrated assessment approach."

October 22, 1998. Meeting with Dr. Marvin Waterstone of the UA Department of Geography regarding his potential participation in the institutional analysis phase of the urban water study.

October 22-23, 1998. Held meetings to allow CLIMAS team members and Janie Chermak, Laura Huenneke, Wil Orr and Wayne Mooney of the Southwest Regional Assessment team to become acquainted and to begin working on how to incorporate the CLIMAS urban water and ranching studies into the regional assessment.

October 27-28, 1998. Hosted Philip Mote from the Pacific Northwest Climate Impacts group. Scheduled a special CLIMAS team meeting for members to meet Phil and hear about the PacNW research on Tuesday afternoon. Arranged for a meeting of Phil Mote, Bill Sprigg, Roger Bales and myself to discuss regional assessment questions on Wednesday morning.

October 28-October 31, 1998. Represented CLIMAS, ISPE, and the Udall Center at the USGCRP Native Peoples/Native Homelands workshop in Albuquerque, New Mexico.

November 17, 1998. Attended board meeting and general meeting of the Environmental Technology Industry Cluster organization. Networked with potential stakeholders.

November 1998. Publish results of Arizona Convective Outlook Survey.

December 1998. Publish second issue of CLIMAS newsletter.

December 1998. Publish white paper on the context of climate impacts in the southwest.

December 1998. Publish report on pilot Stakeholder Survey.

December 1998. Publish white paper on status of forecasting for the Southwest.

December 1998. Publish white paper on urban water sensitivity analysis. The Core Office manager is directing the urban water study, including giving assignments and monitoring the progress of the RAs and undergraduate intern working on various aspects of the project, editing written work, and providing narrative where needed in final products (for example, with regard to reviewing literature setting the foundations for the theoretical and methodological approaches being used) and contributing to analysis of results. In addition, the Core Office manager is a key focal point for integrating the urban water study into the USGCRP regional assessment process.

December 1998. Publish results of Convective Outlook web survey.

February 1999. Give presentation on CLIMAS project to group at UC Boulder.

March 1999. Participate in panel on national assessment at annual meeting of the Association of American Geographers, Honolulu, Hawaii. The program manager organized and will chair an illustrated paper session which will include three presentations by RAs working on the CLIMAS project.

June 1999. Session on CLIMAS scheduled for national ASCE conference, Tempe, Arizona. To be followed by a focus group/workshop session with civil engineers regarding their needs for and use of climate information.

Spring 1999. Sessions on CLIMAS research scheduled for Applied Anthropology Conference, Tucson, Arizona.

Spring 1999. Session scheduled for AGU on climate assessment activities. Being organized by Philip Mote, with assistance from Roger Bales.