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**ANNUAL ACTIVITY REPORT**  
**October 1, 1996 - September 30, 1997**

**UNIVERSITY DEVELOPMENT LINKAGES PROJECT,  
"DEVELOPMENT OF SUSTAINABLE AGRICULTURE  
IN ARID REGIONS OF CHILE"**

**COOPERATIVE AGREEMENT NO. PCE-5063-A-00-3033-00**  
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**PROJECT DIRECTOR/PRINCIPAL INVESTIGATOR:  
BARBARA N. TIMMERMANN, PH. D.  
THE UNIVERSITY OF ARIZONA**

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## “DEVELOPMENT OF SUSTAINABLE AGRICULTURE IN ARID REGIONS OF CHILE”

*The goals of this project are: 1) to encourage values for management of arid lands in Chile, and 2) to develop human resources for teaching and interdisciplinary research.*

### **Objective 1**

**To develop institutional capabilities for education and research by enabling scholarship to focus on the economic, ecological and social factors that will determine the long-run sustainability of agriculture in arid regions of Chile.**

### **Accomplishments**

1. The Universidad de Chile (UCH) and The University of Arizona (UA) faculty participated in two significant events during the last quarter of 1996. Dr. Donald Nelson from the UA offered a presentation at the Annual Meeting of the Sociedad de Biología, Viña del Mar, Chile in early October on the present status of research on transgenic plants adapted to saline and arid environments (see Attachment 1). The meeting was also attended by the PI/PD, Dr. Barbara Timmermann, who presented the results of her research in Chile.
  
2. The second event jointly organized by The University of Arizona's Office of Arid Lands Studies/Arid Lands Information Center (OALS/ALIC) and the UDLP Project with input from the UCH-Sistema de Servicios de Información y Bibliotecas (SISIB) and the Agronegocios Center (CIE) was a Course/Workshop in New Instruments and Strategies for Accessing Agricultural Information. Ms. Barbara Hutchinson from ALIC organized this event which has been considered very successful and useful for librarians and information specialists attending the course. During the opening ceremony of the workshop, Soledad Ferreiro, Director of SISIB, Barbara Hutchinson and Professor Manuel Arroyo addressed the 33 Chilean participants. The substantive training was delivered by specialist consultants from the Centro de Agricultura Tropical - CIAT, Colombia. (For details, see Objective 3, Accomplishment 5 and Attachments 2 and 3.)
  
3. A result of the course/workshop "New Technologies and Strategies for Accessing Agricultural Information" co-sponsored by this UDLP, last October in Santiago, UCH libraries have initiated a review of their information capabilities and are developing skills to access the Internet through the integrated optical fiber internal network and the UCH "ABELLO" server. This activity should be having a great impact in terms of research and quality of faculty publications. A special effort has been made to schedule an evaluation on the degree of applicability and the lessons learned from this event in other participant institutions.

4. Professor Juan Velozo, from Universidad de Chile (UCH), undertook a three-month training under the guidance of Dr. Barbara Timmermann at The University of Arizona (UA). Upon his return to Santiago, he prepared a report which reflects the accomplishments made and future activities. A copy of this report related to research methodology and new techniques on arid lands plant stress resistance is attached to this report as Attachment 4.

Upon return to Chile, Prof. Velozo resumed his teaching and research position at the University of Chile.

5. UCH's graduate student, Alejandro Leon, satisfactorily completed his studies during the Spring 1997 semester at the UA. He also registered for the 1997 Summer Session and for Fall 1997 semester at the UA (see Training Component section).

6. As results of steps taken to identify innovative paths to develop the institutional capabilities at the UCH in connection with this UDLP, Professor Claudio Meneses has completed a research proposal for discussion with UA counterparts in order to review its submission for funding to external agencies. He was expected to spend a period of faculty exchange at the UA during March-May 1997, but the recent reorganization at UCH did not allow him to travel. More initiatives of this type are expected to be developed in the course of 1998.

7. Two additional UCH researchers selected to go to the UA to work for a short-period (up to three months) under the guidance of UA professors, have been organizing their respective materials and background information. These young scientists are expected to qualify for becoming UCH faculty once the process of UCH reorganization allows to hire them on a permanent basis as new faculty members. The selected researchers to train at the UA are:

- Lic. Lohengrin Cavieres, a Ph.D. student, under professor Dr. Mary Kalin, will work for two months with Dr. Larry Venable at UA where he will work on ecological models of arid plants evolution during the first quarter of 1998.
- Lic. Barbara Saavedra, Department of Biology, will work with Dr. Julio Betancourt at The University of Arizona. Arrangements are being made for her undertaking this training fellowship during the first quarter of 1998.

8. Two short-courses have been prepared by UA professors which will be offered during 1998 in Chile:

Course No.1 "Selected Topics in Economic Botany", Professor Steve McLaughlin

Course No.2 "Advances in Integrated Watershed Management", Professor Peter Ffolliott

### **Objective 2**

**To develop long-term research topics in arid lands studies and to disseminate research results achieved by UA and UCH.**

Following a severe drought period, heavy rainfall due to a change in the "Niño Current" has caused a variety of natural disasters in the country. The effects on project's research are under assessment, although the first draft of the research sub-project, "Analysis of Agriculture Production Systems and Utilization of Natural Resources in the Limari River Watershed", has been completed. A publication is being prepared, and a synthesis of it will be presented at the 1997 Agronomic Congress in November 1997.

Progress reports on "Resolution of Environmental Conflicts in Arid Lands", are being compiled by UCH. This project, related to residual disposal, now counts with a conceptual framework to solve conflicts arising from public measures affecting urban-rural interphases in arid and semi-arid locations. The results of this research are being polished and should be ready for publications within the next quarter. The young researcher in charge of this project has moved from UCH's Arid Land Program (ALP) to the National Environmental Commission, where he holds a public servant position. At present, he is being trained there on a variety of environmental methodologies. It is expected, however, that the project will be completed in due course

### **Objective 3**

**To establish an international arid lands network for sharing results and experiences.**

The objectives of the information management components of the Chile/U.S. University Linkages Project are to: 1) disseminate research results achieved by the University of Arizona (UA) and the University of Chile (UCH); 2) establish an international arid lands network for sharing results and experiences; and 3) establish an updated specialized library at the University of Chile on current arid lands sciences in support of educators, researchers and students. During the fourth year of the project, we made progress in achieving all of the information management objectives as outlined below.

## Accomplishments

1. The fifth and sixth issues (V.3, No. 1 and No. 2) of the newsletter, Tierras Aridas: Conexiones (Attachment 5), were published and distributed to a mailing list of 57 people. The seventh issue, V. 4, No. 1, is in process. All newsletters also are available on the Internet through the Office of Arid Lands Studies (OALS) World Wide Web site. The issues of the newsletter Tierras Aridas-Conexiones have been received and distributed at UCH. Expressions of satisfaction on the results of the course/workshop New Technologies and Strategies for Accesing Agricultural Information have been received from different participant institutions in Chile. The added sections of the newsletter are very useful and do contribute to enhance information exchange on new events, publications and books.
2. Information modules continue to be developed on arid lands-related topics for the Web site. Interested persons are able to access the information using the following URL: (<http://ag.arizona.edu/OALS/oals/oals.html>). One of the items available for selection is the UP/Chile Linkages project. Besides general information about the project, it includes hypertext links to information on sustainable agriculture, arid lands topics, and other related resources on the Internet. This list is currently being reviewed and annotated to facilitate users in appropriate selections.
3. The FAO Newsletter on Arid Lands Networking is being considered for inclusion in the UDLP Project site of the Web since it complements well with the project's own newsletter, Tierras Aridas: Conexiones.
4. At the request of Manuel Arroyo, a list of arid lands-related journals, complete with address and contact information, was prepared for UCH's Arid Zone Program.
5. The proposed workshop on using new technologies for accessing agricultural information was held at the Universidad de Chile (UCH), October 2-4 , 1996. This workshop was funded by the International Association of Agricultural Information Specialists (IAALD) and by the USAID through this UDLP project. Arrangements for the workshop were made by the Sistema de Sevicios de Informacion y Bibliotecas at the UCH. It was attended by 33 information specialists and agronomists from throughout Chile. Barbara Hutchinson, Director of the Arid Lands Information Center, assisted the two workshop facilitators, Sra. Luz Marina and Sr. Mariano Mejia, both from the Cento Internacional de Agricultura Tropical (CIAT) in the preparations and execution of the workshop in Santiago, Chile. A detailed account of the workshop is attached (see Attachments 2 and 3).
6. As an offshoot of the UDLP workshop/course held in October 1996 (see Attachment 2) directed towards specialized librarians covering the problematic of arid

lands, a renewal of library facilities has taken place at the University of Chile. Librarians have continued to be trained locally, libraries at the UCH have modernized some equipment and facilities, thus allowing students to have now access to a computerized library systems where searches and utilization of INTERNET is benefitting students and professors/researchers alike.

#### **Objective 4**

**To establish an updated specialized library at UCH on current arid land sciences in support of educators, researchers and students.**

#### **Accomplishments**

1. The UA continues supporting the UCH unit with news on upcoming events related to arid lands, water resources and colloquia at UA, as well as with research bulletins and reports.
2. Researchers at UCH are pleased to continue utilizing the Internet. E-mailing has been extremely useful during the preparation of the V Latin American Course on Desertification and Sustainable Development.
3. Due to a variety of circumstances, among them re-scheduling of financial support by the IDB, UNDP, UNEP and other organizations, the date of the course programmed for the period July 21 - August 4, 1997, has been moved forward to October 20 - November 5, 1997.
4. Internet utilization by the UCH side of the project has been increasing. A mailing directory of UCH and related universities on information being received from Infoterra, Agmodels, Econ-ecology is under preparation.
5. The search of new technical documents related to degradation of natural resources in other regions of Chile has been continued. It will become very useful for the upcoming international course on sustainability and desertification (see below).
6. Internet utilization by UCH has been increasing. A mailing directory of UCH and related universities on information being received from Infoterra, Agmodels, Econ-ecology is to be implemented during the forthcoming quarter.
7. The V International Course in Sustainability and Desertification (see Linkages section below) will enrich the document base on degradation of natural resources in Chile and other Latin America countries as the selected participants are being asked to bring a bibliography of relevant materials of their respective countries.

8. The UCH/UDLP project's 486 computer is becoming limited due to technological advances. It is considered necessary to update it with a Pentium and enlarged hard disc and memory in order to be able to cope with other compatible equipment. The desk laser printer, and photocopying machine purchased by the project still are giving good service. A scanner and data show equipment is also now required by the project. In due course a request for authorizing purchase of these elements will be made so the project may function adequately.

## LINKAGES

Concomitant activities related to the UA/UCH project during this period are strengthening the relationships among professionals working in arid lands aiming at sustainability of the resource base.

(1) The "V International Course on Desertification and Sustainable Development" for Latin America and the Caribbean" has finally been funded. Originally conceived for October 1996, was moved to July-August 1997, by now has been finally organized for the period October 20- November 5, 1997. The funding has been obtained from IDB, FAO/UNEP; CONAF/UNDP and the Secretariat of the Desertification Convention. The original title has been changed. Twenty-two participants from 13 countries of the region out of 97 government-sponsored nominees have been selected, plus 8 Chileans. The Consortium, comprising Argentina (Instituto Argentino de Investigación en Zonas Áridas-IADIZA), Brasil (EMBRAPA), Chile (University of Chile - Arid Land Program) and México (Colegio de Postgraduados de Montecillo), is the foundational institutional set-up for this endeavour. Our UDLP project is linked through the UCH Arid Land Program to training of professionals of the region in conjunction and support with above mentioned financial institutions which are merging forces to assist in national efforts to combat desertification Latin American countries.

(2) A private university, Universidad Educare, invited UCH's ALP to make a presentation on desertification in Chile as a manner to update students and faculty on the relevance of the phenomena. The task was organized and delivered by Professor Manuel Arroyo. Desertification has become particularly important in a year when drought is an issue that affects not only arid regions but also, and very strikingly, the capital city of Santiago. Water shortage has made it necessary to establish rationing. The rivers from the IV to the VII regions have been or are about to be intervened for regulating water distribution. In this vein, other universities have signaled interest to be included in this ALP outreach program to distribute information on desertification research results.

(3) In view of UDLP fund restrictions, UCH decided not to participate in the BLM-

sponsored symposium/ workshop on "Combating Desertification: Linking Science and Community Action", held in Tucson, May 12-16, 1997.

(4) A book entitled " Diagnóstico de la Desertificación en Chile" has been recently published. It is one of the follow up activities of the Chilean National Action Plan to Combat Desertification. The Plan and this book were prepared by a group of ALP professors. The Minister of Agriculture and the Director of CONAMA (National Environmental Commission) and the Director of CONAF (Corporación Nacional Forestal) launched the book in August 1997, as a recognition of the importance of desertification processes in Chile and signaling the governmental policy decision to back this problem to its full extent.

(5) At present, the new national coordinator for the desertification plan has, in addition to the advisory committee in which ALP plays the role of "scientific and intellectual", organized component regional commissions for tackling desertification at the local level. As 1996/97 was affected by one of the most severe droughts of this century, up until July 1997 there was no hope things would change. This devastating phenomenon had curtailed agriculture production not only in arid and semi-arid lands, but also throughout the entire farm country. With the arrival of rains, however, things have changed, but it has also caused severe damages of a different nature -- through flooding and damage to roads and constructions. The importance of taking counteracting measures has become evident and the National Plan of Action to Combat Desertification now has a place in the government agenda.

(6) The regional range management course has lost its importance at FAO Headquarters due to financial restrictions. It is clear that it will not be funded in 1998/89.

(7) The University of Chile has suffered a serious setback during the period May-July 1997 as it practically was closed to all academic activities due to a student uprising. This situation coupled with the still on-going downsizing process called "Optimization" has seriously detained implementation of programmed and envisaged activities linked to this UDLP project. The situation is at present under a negotiated "tri-estamental" process of study, which covers the re-definition of the University's mission, a renewed strategic plan, and definition of financial mechanisms and funding by the Government.

## ATTACHMENTS

- 1 Report of Visit to the University of Chile by Dr. Donald Nelson (October 1996)
- 2 Workshop Program in Santiago, Chile, and List of Participants (October 2-4, 1996)
- 3 Selected Photos from Workshop in Santiago
- 4 Report from Prof. Juan Velozo
- 5 Newsletter Tierras Aridas: Conexiones, V. 3, No. 1
- 6 Newsletter Tierras Aridas: Conexiones, V. 3, No. 2

## REPORT OF VISIT TO THE UNIVERSITY OF CHILE DR. DONALD NELSON - OCTOBER 8-18, 1996

### INTRODUCTION

Five goals were presented in the proposal for travel submitted prior to my trip to Chile. These included 1) presentation of a seminar at the Chilean Society of Biology national meeting, 2) presentation of a special seminar at the University of Chile, Santiago, 3) discussion of potential investigation lines for a biotechnology program, 4) tours of the facilities presently available for molecular biology, and 5) identification of faculty/academics who may visit The University of Arizona. Each of these areas are discussed in separate sections following the introduction.

My host for the trip was Prof. Gladys Fernandez of the Department of Agricultural Production. Extensive discussions were held with Marina Gambardella and Ricardo Pertuze, also of the Department of Agricultural Production. Marina and Ricardo currently have primary responsibility for establishing a biotechnology program at the university. Other contacts include Prof. Edmundo Acevedo, Dean of the Faculty of Agriculture and Forestry, Prof. Manuel Arroyo, Department of Rural Development, and Dr. Carlos Muñoz Schick, Director of Plant Biotechnology at the INIA (Instituto de Investigaciones Agropecuarias) laboratory in La Pintana. This government-sponsored research laboratory is adjacent to the University of Chile's agriculture campus.

In addition to the Society of Biology meetings, the visit to the university, and a visit to INIA, I also had the opportunity to travel extensively in Chile with Prof. Acevedo. The purpose of the trip was to observe methods of sustainable agriculture being introduced and used by Chilean farmers and agronomists. These included visits to sustainable pastures which combine salt tolerant shrubs, such as Atriplex, with legumes and grasses capable of reseeding. We also visited two farms, one of only two acres and the other having 1000, both of which had successfully introduced no tillage production. We also visited one Experiment Station belonging to the university and a branch of Chile's closest equivalent of the Extension Service.

Clearly, the need exists for understanding and utilizing biotechnology in Chilean agricultural production. Not only would such technology assist Chilean scientists in evaluating and producing improved crop varieties but also to evaluate advanced varieties and transgenic species which are being introduced to Chilean agriculture by international agencies and corporations.

### SUMMARY OF PRESENTATION AT THE SOCIETY OF BIOLOGY MEETING

Work in the laboratories of Hans Bohnert and Richard Jensen over the last five years has resulted in the detection of several mechanisms that allow crop plants to maintain meristematic growth longer under conditions of stress, while other plants stop growing. The basic approach is to generate transgenic plants in which several of these mechanisms are combined. The specific physiological processes (and genes) which are being targeted for modification are:

- (1) Compatible solute biosynthesis (genes encoding mannitol dehydrogenase, inositol methyltransferase, sorbitol dehydrogenase)

- (2) Potassium uptake (genes encoding low affinity channel and high affinity transporter)
- (3) Water transport (genes encoding six membrane intrinsic proteins)
- (4) Oxygen radical scavenging (genes encoding superoxide dismutase, catalase, ascorbate peroxidase).
- (5) Active methyl cycle (genes encoding SAM synthase and SAH hydrolase).
- (6) Sodium exclusion/compartimentation (gene encoding the sodium/proton antiporter).

Recent work, through which we have become familiar with the molecular basis of long-known physiological observations, is permitting us to understand the biochemical meaning and significance of genes which synergistically and additively govern environmental stress tolerance. While recent progress has largely been due to gene cloning and descriptions of cell-, tissue- and developmental stage-specific expression of stress-responsive genes, future work will have to include biochemical analysis of cloned genes to a much greater extent.

### SUMMARY OF SPECIAL SEMINAR AT THE UNIVERSITY OF CHILE

Transgenic plants may soon become important components of agriculture production in several countries. As for other technologies, developing countries must consider the use of transgenic plants to either remain competitive in the export of certain crops or to address production problems specific to their respective countries. Three main points were the focus of the talk.

First, transgenic plants are already economic reality. Consumption and utilization of the products of transgenic crops have begun in some countries. In Chile itself, more than 18 field trials of transgenic plants have been conducted. Second, transgenic plants represent diversification in two important ways. We will be able to utilize the genetic resources of all living species rather than be limited, as a traditional plant breeding approach is, to using the resources of only closely related species. Transgenic plants also represent diversification in that more and more plants will be developed and used for non-food and non-fiber purposes rather than the mainly food and fiber purposes used until now. Lastly, Chilean farmers and scientists will be responsible for determining "appropriate use" of transgenic plants in agricultural production. The actual production of transgenic plants is relatively easy compared to determining whether the use of transgenic plants in a given agronomic situation is good. Transgenic plants do not represent alternatives to good agronomic practice but rather more simply as alternatives and additions to the varieties produced by breeding.

The balance of the seminar included presentation of various statistics concerning the production and use of transgenic plants worldwide, presentation of state of the art techniques in producing transgenic plants, and finally, specific case studies of transgenic crop species. These included petunia, tomato, potato, and problems addressed e.g. disease resistance, productivity, and trait enhancement (taste and color).

### POTENTIAL INVESTIGATION LINES

The large variation in rainfall (from 0 to 4 meters from north to south) and the concentration of population in some of the most productive portions of the country have combined to create at least three distinct agronomic situations where aridity and/or salinity are problems. First, in the

north, low rainfall has created a traditionally defined desert. Here, drought and salt tolerant crop species are being developed. Second, in the central region, rainfall is adequate and but should be supplemented with irrigation during drier seasons of the year. However, the large population in this region now leaves little runoff water available for irrigation purposes. Finally, in the south, where rainfall levels are high, traditional tillage practices have resulted in severe erosion. This has led to decay of soil quality and to a lesser ability of the soil to retain moisture.

Several of these problems should be addressed by management practices and water use policies and not by biotechnology. However, biotechnology especially in the area of molecular markers may be useful for identifying and selecting varieties capable of productive growth in marginal zones. For example, several salt tolerant jojoba lines have been identified and are already being utilized in production. Further improvement in these lines could be attained by marker-assisted selection of progeny derived from crosses of the various lines.

#### DETERMINATION OF FACILITIES AVAILABLE FOR BIOTECHNOLOGY

Tissue culture is currently conducted at the University of Chile but essentially no other techniques are currently being utilized. The university has little basic equipment necessary for biotechnology protocols. Adjacent to the university, the government-sponsored INIA research laboratory has recently obtained all of the advanced equipment necessary for such research. The laboratory is well organized and efficiently run. However, there remain several unfilled positions there due to the inadequate supply of trained personnel. Discussions with Dr. Carlos Muñoz indicated his willingness to cooperate in any training short course to be developed. Clearly, the greatest need at the present time is training in biotechnology protocols.

#### IDENTIFICATION OF ACADEMICS TO VISIT THE UNIVERSITY OF ARIZONA

Loreto Canaves, a full time academic in the Department of Agricultural Production, wishes to pursue a Masters Degree at The University of Arizona. Her interests are in the area of physiology of arid zone plants.

#### SUMMARY

Attempts to establish biotechnology work at the University of Chile so far have been unsuccessful. The main barrier seems mainly to be lack of equipment. Several of the staff and faculty there have attended workshops and courses held at other locations, national and international, and are eager to adopt such technologies. In particular, the Dean of the Faculty is highly supportive of such approaches.

Grant proposals have been submitted to fund purchase of the necessary equipment and if such equipment were to become available, in-house training would greatly facilitate the initiation of biotechnology research at the University of Chile. Also, there is potential for collaboration between workers at the University of Chile and the INIA laboratory.

The immediate goal now is to assist the contacts made during this trip to identify a specific research project which would benefit from the utilization of a biotechnology approach. When a project is identified, a specific plan for a training course will be proposed.

# ATTACHMENT 2

## NEW TECHNOLOGIES AND STRATEGIES FOR ACCESSING AGRICULTURAL INFORMATION: A REPORT ON A WORKSHOP HELD IN SANTIAGO, CHILE - OCTOBER 2-4, 1996 Barbara Hutchinson, Luz Marina Alvare, and Mariano Mejia

### I. INTRODUCTION

A three-day training course on using new technologies for accessing agricultural information was held October 2-4, 1996 at the Universidad de Chile in Santiago. It was attended by 30 Chilean agricultural information specialists and agronomists who came together to gain greater understanding of the changing information environment and to expand their knowledge of CD-ROM databases and the Internet. The course was funded by the International Association of Agricultural Information Specialists (IAALD) and the U.S. Agency for International Development (USAID) through a University Development Linkages Program grant (UDLP) to The University of Arizona (UA) and the Universidad de Chile (UCH).

The training course began with introductions and remarks by Sra. Soledad Ferreiro, Directora de Sistema de Servicios de Informacion y Bibliotecas (SISIB) and the Centro de Informacion Estrategica para Agronegocios (CIE) at UCH, Professor Manuel Arroyo, Director of the Programa de Zonas Aridas at UCH, and Barbara Hutchinson, Director of the Arid Lands Information Center at The University of Arizona, USA. They outlined the year-long process for obtaining the necessary funding and for organizing the training course. In particular, information was given about the two primary funding agencies.

IAALD is an organization of information professionals that was established in 1955 to promote and advance public education and information transfer in agricultural development and production. The mission of the Association is to facilitate professional development and communication among members of the global agricultural community. IAALD's objective is to enhance access to and use of agriculture related information resources. Specific activities include publishing a Quarterly Bulletin, directories and other publications; organizing World Congresses and regional meetings; collaborating with related agencies and donor organizations to organize joint activities and cooperative actions; and conducting training programs worldwide. IAALD actively seeks funding support to assist individuals from low-income countries to participate in these activities.

One of USAID's programs is the University Development Linkages Project (UDLP). This program was created to promote and support the collaboration of U.S. colleges and universities with developing country institutions of higher education. In 1993, through the UDLP, The University of Arizona (UA) and the Universidad de Chile (UCH) received a five-year grant to establish a collaborative, interdisciplinary program to strengthen research, education, and the dissemination of information in the field of sustainable arid lands agriculture. One of the objectives of this UDLP is to build resource sharing and dissemination capabilities for arid lands and agricultural information at the Universidad de Chile. Although not included as part of the original proposal, collaborators in Chile and Arizona determined that a workshop focusing on the use of electronic information technologies would provide a valuable mechanism for fostering greater interaction between the two universities. Recognizing the networking potential provided

by such a workshop, the collaborators decided to open it up to agricultural information professionals from throughout Chile.

Each of the opening presenters expressed hope that this training course would lead to greater communication and resource sharing among all the participants and throughout Latin America. In particular, Sra. Ferreiro stated the importance of strengthening the capacity of information professionals to incorporate new technologies into their work environments. As a result of this workshop, she expressed hope that other opportunities for training will be possible in the future.

## II. COURSE EXPECTATIONS

The first day's activities began with an introductory exercise presented by the two training course facilitators, Sr. Mariano Mejia, Coordinador de Servicios al Publico, Unidad de Informacion y Documentacion, and Sra. Luz Marina Alvare, Coordinadora de Procesos Tecnicos, Unidad de Informacion y Documentacion, both from the Centro Internacional de Agricultura Tropical (CIAT) in Colombia. Workshop materials were handed out including copies of the overheads for each lecture and copies of the new Spanish-language CAB CD-ROM Manual (donated by CAB International). The participants were given time to interview each other to learn more about their professional experiences and interests. Following this initial dialogue, the participants introduced each other formally to the entire group. This was a very successful method for bringing the group together and for preparing everyone for the following sessions. Selected photographs of the participants and the training site are shown in Attachment 3.

Next the participants were given the opportunity to express their particular expectations for what they would like to learn during the training course. The following points were made:

- Practical applications of new technologies
- Increased networking and communication
- How and where to find agricultural information
- Related databases
- Internet resources in other subject areas
- Agribusiness information
- Representative URLs and other resources
- Use of Thesauri

These expectations for the training course were on target with the activities already planned and substantiated the need for this kind of learning opportunity.

## III. CHILE'S NATIONAL AGRICULTURAL INFORMATION SYSTEM AND THE ROLE OF THE CENTRO DE INFORMACION ESTRATEGICA (CIE)

Mr. Raul Dastres Abarca, Director Centro de Informacion Estrategica (CIE) at SISIB, gave a presentation on the events leading up to the creation of CIE. The decision was based on a number of concerns including the lack of agricultural information dissemination services, the lack of factual data and information for decision-making, an inability of users to articulate needs, lack

of understanding on supply and demand, and a strong need for information, but low demand. Factors for making a successful information service in agribusiness were outlined. These included: a) a high diversity and quantity of national and international resources; b) appropriate access mechanisms; c) coordinated information management; d) the support of information specialists, and e) a clear understanding of marketing. Mr. Dastres suggested these factors are key to an effective program. He also documented the existing national agricultural information system in Chile and described the services that SISIB is providing to the system through its service to the academic and business communities. An example of this support is the facilitation of training opportunities such as this particular course. Following his presentation, Mr. Dastres encouraged the participants to describe their particular needs. CIE reported its experience has been successful in the agricultural environment of Chile; however, it is necessary to establish mechanisms to assure that these services be complemented by various information services given by other agricultural institutions in the country, such as research institutions and universities. By this way, users will have more accessing opportunities to better information, and possibly at lower costs.

#### IV. COURSE CONTENT

##### A. Institutional Change at the Centro Internacional de Agricultura Tropical (CIAT)

As an example of the development of a large research system for agriculture, Mr. Mejia gave an overview of the history of CIAT, focusing in particular on the changes affecting the products and services for information and documentation. CIAT, as with other organizations, is having to restructure due to changes in financial support. Questions from the participants focused on the fees charged for services and the reactions of users, considering that formerly information services were free. "The process has been slow, because most of our users didn't use to pay for information services; however, these changes have contributed to rationalize the services, save resources, and make people understand that providing information services is expensive. Today, our users are more specialized, and most of them pay gladly for a good information service", said Mr. Mejia.

##### B. Using New Technologies for Information Access

The first day's afternoon sessions provided both an overview of the new technologies for accessing agricultural information and the changes in administration required to take advantage of the new technologies. Highlights included suggestions on how to choose a system using such factors as: budget cuts, user demands for better access, user-friendly systems, and requests for new products and services. Systems needed are public access, acquisition, cataloging, circulation, serials control, and administration. Desirable characteristics are user-friendly, flexible, versatile, able to generate reports, and authority controlled.

In the process of using new technologies for the new age library, standards for information processing are considered very important for sharing resources and to ease the communication. The impact of using standards can be seen in increasing processing efficiency, easy information exchange, wider audience, and lower costs which are reflected in a better knowledge transfer.

Participants in general were worried about the cost of moving toward new technologies. "It

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is demonstrated that the rational use of new technology results in lower costs for both the users and the providers, and services can be provided in a faster and more efficient way", said Mrs. Alvare. She also gave some real examples regarding this matter comparing the use of airmail, fax, and Ariel (Internet) for document delivery.

### C. The Internet

The second day of the course focused on the Internet and practical hands-on training in its use. Presentations looked at the unique features of this revolutionary communications technology and suggested its potential to act as a global library for use by everyone in the world. Specifically, the evolution of information technology was traced leading to current client-server systems. Web search engines were identified and tried out in the hands-on sessions. Twenty computers with live Internet connections provided the means for participants to try their hand at searching the Web. Practice exercises guided this process. One of the resources given during the training that the participants appreciated was a diskette containing CIAT's bookmark of selected institutions and tools for agricultural information.

### D. Information Sources for Agribusiness

The second day also included an overview of electronic resources for agribusiness information. Beginning with an introduction to types of general business information such as industry surveys and specific public and private company directories, this presentation covered product lines from print and CD-ROM to online and Web resources. In particular, databases and Web sites were featured that provide statistical data, marketing and new product information, international trade requirements, and bibliographic information. Lists of relevant home pages were included in the handout for this session.

### E. Use of Thesauri

The final day of the course provided a discussion and hands-on training in the use of boolean search strategies and the use of thesauri to modify and enhance electronic searches for topical and targeted information.

In general, most of the participants have "gaps" in these topics, mainly due to lack of practice or specialized use. Through practical exercises and explanations participants were able to remember and reinforce their skills to analyze properly technical documents.

## V. COURSE EVALUATIONS

A comprehensive evaluation questionnaire was given to all participants at the end of the training course. Ten specific questions were asked as well as a final overall impression. Five categories offered options for *no comment*, *deficient*, *average*, *good*, and *excellent*. In all responses the participants overwhelmingly selected the *excellent* and *good* categories. Selected results are outlined below (complete evaluation summary is available from the authors).

### 1) Evaluate the objectives of the event in terms of your institutional and personal

**needs, and according to the outcome of the event.**

The combined rating of the objectives was *excellent* (25) and *good* (5). Comments included: "it fulfilled all my expectations"; "a new, expanding horizon opened up before me".

**2) Evaluate the course's contents according to whether they filled gaps in your knowledge before the workshop (2.1 - National review of agricultural information; CIAT's experience, general vision of agricultural information; administration of agricultural information; 2.2 - suggested search strategies and use of thesauri; 2.3 - use of Internet).**

Ratings in these areas also followed a similar split between *excellent* and *good*, with the *excellent* category selected between three times more than the *good* category. Comments included: "brief, concise, and precise"; "I had gaps of knowledge on these topics which are now completely filled"; "the only fault I found with this part of the workshop was that it was too short".

**3) Evaluate the methodological strategies used for instructor's presentations, work groups, quantity and quality of educational materials, evaluation systems, practices, and teaching aids.**

Although the instructors were rated as *excellent* by all of the participants, there were a number of comments about needing more time for practice. This was a common theme mentioned by many of the participants.

**4) Evaluate the applicability (or usefulness) of what you learned for your current and future work.**

In this category, participants gave 23 *excellent* ratings and seven *good* ratings. Comments were variations on this theme, "I have access to Internet but had not been able to use it, until now."

**5) Evaluate the local coordination of the event, including information to participants, schedules kept, agenda completed, coordination of groups, coordination of activities, and logistic support.**

The average split for this category was 27 with an *excellent* rating and three with a *good* rating.

**6) Evaluate the workshop in terms of its proposed objectives and content.**

In this category, a *good* rating was given by 17 participants and an *excellent* by 11 participants, with several *no comments*. Suggestions for improvement were oriented toward offering more days for the workshop so that additional practice time would be possible.

**7) Evaluate other activities and/or nonacademic situations that positively or negatively influenced your level of satisfaction with the workshop (food, site of workshop, logistic conditions, and transport).**

While a significant majority of the participants gave a rating of *excellent* in this category, there were comments that a larger conference room with a microphone would have been an improvement.

**8) List workshop's strong points.**

Comments:

- excellent presentation of topics; good level of information provided
- gaps in knowledge were filled
- the professionalism of the organizers and speakers...
- the relevance of the topics dealt with...
- speaker's knowledge of the topics...
- we received valuable tools that will allow us to plan and establish new services.

**9) List workshop's main weaknesses.**

Comments:

- the little time in which to practice
- acoustic problems
- perhaps more time to explore certain topics

**10) Provide specific suggestions to improve this type of event both academic and nonacademic.**

Academic Comments:

- more time and equipment for practices
- explore each subject more
- divide the group between those who have experience and those who do not

Nonacademic Comments:

- more information about these events at university level or contacts
- acoustic problems
- coffee break needed during last afternoon

**11) How would you qualify this workshop overall.**

An *excellent* rating was given by 27 participants and a *good* rating was given by three participants.

## VI. CONCLUSION

As can be seen by the course participant's very positive comments, this training opportunity provided a useful and practical introduction to electronic technologies for accessing agricultural information. From this experience, course participants gained increased knowledge about and understanding of the impact of telecommunications technologies on the information organization, and the potential application of these technologies in their own work situation. Through the frank

and helpful comments, course facilitators learned to schedule more time for the practice of these new techniques. However, the final lesson of this workshop is that there should be more of these types of opportunities, both in terms of professional development and in terms of building human networks through the use of new technologies.



UNIVERSIDAD DE CHILE



## CURSO / TALLER

### Nuevos Instrumentos y Estrategias de Acceso a la Información Agrícola

#### PROGRAMA

#### MIÉRCOLES 2 DE OCTUBRE

INSCRIPCIÓN DE LOS PARTICIPANTES	8:30 - 9:00
♦ INAUGURACION	9:00 - 9:30
Sra. Soledad Ferreiro, Directora. Sistema de Servicios de Información y Bibliotecas (SISIB) U. de Chile.	
Sr. Manuel Arroyo, Coordinador. Programa de Desarrollo ZONAS ARIDAS, U. de Chile - U. de Arizona	
Sra. Barbara Hutchinson. Directora. Arid Lands Information Center (ALIC), U. of Arizona, USA.	
♦ Integración / Revisión expectativas Presentación del Programa	9:30 - 10:30
♦ Descanso (café)	10:30 - 10:45
=====	
1. Panorama nacional de la Información Agrícola. (Raúl Dastres, CIE- SISIB, U. de Chile)	10:45 - 11:45
2. Experiencia del CIAT en el manejo de Información Agrícola (Mariano Mejía, CIAT - Colombia)	11:45 - 13:00
♦ Almuerzo	13:00 - 14:30
3. Acceso a la Información Agrícola usando nueva tecnología. Visión General - Tendencias (Luz Marina Alvaré, CIAT - Colombia)	14:30 - 15:30
Discusión	15:30 - 15:45
♦ Descanso (café)	15:45 - 16:00
4. Acceso a la Información Agrícola usando nueva tecnología. Administración	16:00 - 17:00
Discusión.	16:30 - 17:15
5. Mecanismos para recuperar Información Agrícola regional. Un caso.	17:15 - 18:00

Sistema de Servicios de Información y Bibliotecas. SISIB. Universidad de Chile.

Av Libertador B O'Higgins 1058 - Of. 123 - Fonos (562) 678-1086 (562) 678-1084 - Fax (562) 678-1081



UNIVERSIDAD DE CHILE



## CURSO / TALLER

### Nuevos Instrumentos y Estrategias de Acceso a la Información Agrícola

#### PROGRAMA

#### JUEVES 3 DE OCTUBRE

- |    |   |               |
|----|---|---------------|
| 6. | Usos de Internet<br>(Luz Marina Alavare, CIAT - Colombia) | 9:00 - 10:00  |
|    | Discusión   | 9:00 - 10:15  |
| •  | Fuentes Electrónicas:                                     | 10:15 - 11:00 |
|    | - Fuentes de Información Agrícola                         |               |
|    | - Recursos bibliográficos                                 |               |
|    | - Herramientas de búsqueda                                |               |
| ♦  | Descanso  | 11:00 - 11:15 |
| ♦  | Navegación asistida                                       | 11:15 - 12:15 |
| ♦  | Navegación libre  | 12:15 - 13:00 |
| ♦  | Almuerzo  | 13:00 - 14:30 |
|    | Fuentes Electrónicas:                                     | 14:30 - 15:30 |
|    | - Servicios de Alerta                                     |               |
|    | - Acceso a documentos                                     |               |
|    | - Listas de discusión                                     |               |
| ♦  | Navegación asistida                                       | 15:30 - 16:00 |
| ♦  | Descanso  | 16:00 - 16:15 |
| ♦  | Navegación libre / asistida                               | 16:15 - 18:00 |

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**CURSO / TALLER****Nuevos Instrumentos y Estrategias  
de Acceso a la Información Agrícola****PROGRAMA****VIERNES 4 DE OCTUBRE**

- |    |  |               |
|----|--|---------------|
| 7. | Estrategias de búsqueda y uso de tesauros<br>(Mariano Mejía, CIAT - Colombia)                            | 9:00 - 10:00  |
| •  | Práctica de búsqueda   | 10:00 - 11:00 |
| ♦  | Descanso   | 11:00 - 11:15 |
| •  | Práctica de búsqueda   | 11:15 - 12:15 |
| •  | Agronegocios. Fuentes<br>(Barbara Hutchinson, ALIC - U. Arizona y<br>Luz Marina Alvaré, CIAT - Colombia) | 12:15 - 13:00 |
| •  | Almuerzo   | 13:00 - 14:30 |
| •  | Demostración. Bases de Datos en Agronegocios<br>(Eurgenio Fourt, CIDE)                                   | 14:30 - 15:15 |
| •  | Descanso   | 15:15 - 15:30 |
| 8. | Servicios de Información CIE - SISIB<br>(Raúl Dastres, CIE- SISIB, U. de Chile)                          | 15:30 - 17:00 |
| ♦  | Evaluación Final del Curso<br>(Equipo coordinador)   | 17:00 - 17:15 |
| •  | Plenaria y Clausura  | 17:15 - 18:00 |

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CURSO/TALLER  
 NUEVOS INSTRUMENTOS Y ESTRATEGIAS DE ACCESO A LA INFORMACION AGRICOLA  
 2,3 Y 4 OCTUBRE 1996

NO.	NOMBRE PARTICIPANTE	INSTITUCION	02.10.96	03.10.96	04.10.96
1	Araya Torrealba, Mabel	Universidad Las Américas			
2	Armijo Silva Armandina Paola	Instituto de Investagaciones Agropecuarias- La Serena			
3	Bassi Silva, Alba	Sociedad Nacional de Agricultura - Santiago			
4	Cabezón Romero, Consuelo	Universidad Católica de Valparaíso			
5	Cabrera Jiménez, María Teresa	Universidad Arturo Prat - Iquique			
6	Calabacero Jiménez, María Antonieta	Universidad de La Serena			
7	Campos Vargas, Reinaldo	U. Chile, Fac. Agronomía			
8	Carrera Recabal, Marcela	Universidad de Magallanes - Punta Arenas			
9	Chesta Riquelme, Ivette	Instituto de Investigaciones Agropecuarias C.R.I.- Osorno			
10	Díaz Ibarra, María Verónica	Instituto de Investigaciones Agropecuarias - Stgo			
11	Escalona Gomez, Ximena del Carmen	Escuela de Administración Agrícola - S.N.A. Paine			
12	Fuentes Troncoso, Leonora	ODEPA			
13	Geldes, Cristian	U. Chile. Programa de ZONAS ARIDAS			
14	Hernández Palominos, Lya	U. de Concepción Campus Chillan			
15	Hernández Saldivar, Gabriela Adela	Pontificia Universidad Católica de Santiago			
16	Inostroza Delgado, María Cecilia	Instituto de Investigaciones Agropecuarias-Temuco			
17	Ladron De Guevara, Juan	U. Chile. Programa de ZONAS ARIDAS			
18	Leiva Tabali, Lilian Inés	U. Chile, Fac. Agronomía			
19	Martínez Roa, Ana María	U. de Chile. SISIB			
20	Mena Orellana, Verónica	Universidad de Talca			
21	Müller Figueroa, Carlos	U. Chile. CIE - SISIB			
22	Ovalle Cáceres, Guadalupe	U. Chile. Fac. Agronomía			
23	Paul Dutrey, Adriana Inés	FAO			
24	Pérez Zamora, Cecilia del Carmen	U. Chile, Fac. Agronomía			
25	Poblete Muñoz, Verónica	CFEN			
26	Pozo Riveros, Gloria del Carmen	U. Chile. Fac. Agronomía			
27	Prieto Román, Rosa	U. Chile. Fac. Agronomía			
28	Rodríguez Riquelme, Inés del C.	Universidad de Tarapacá - Arica			
29	Rodríguez Rojas, Ivonne	Universidad de La Frontera			
30	Rojas Díaz, Gloria Angélica	Universidad Católica del Maule - Talca			
31	Scheuermann Osses, María Eugenia	Instituto de Investagaciones Agropecuarias- Chillán			
32	Seguel Inostroza, Sonia	Universidad Austral de Chile			
33	Sotelo Hernández, Cecilia	U. Chile. SISIB-CIE			

List of Participants

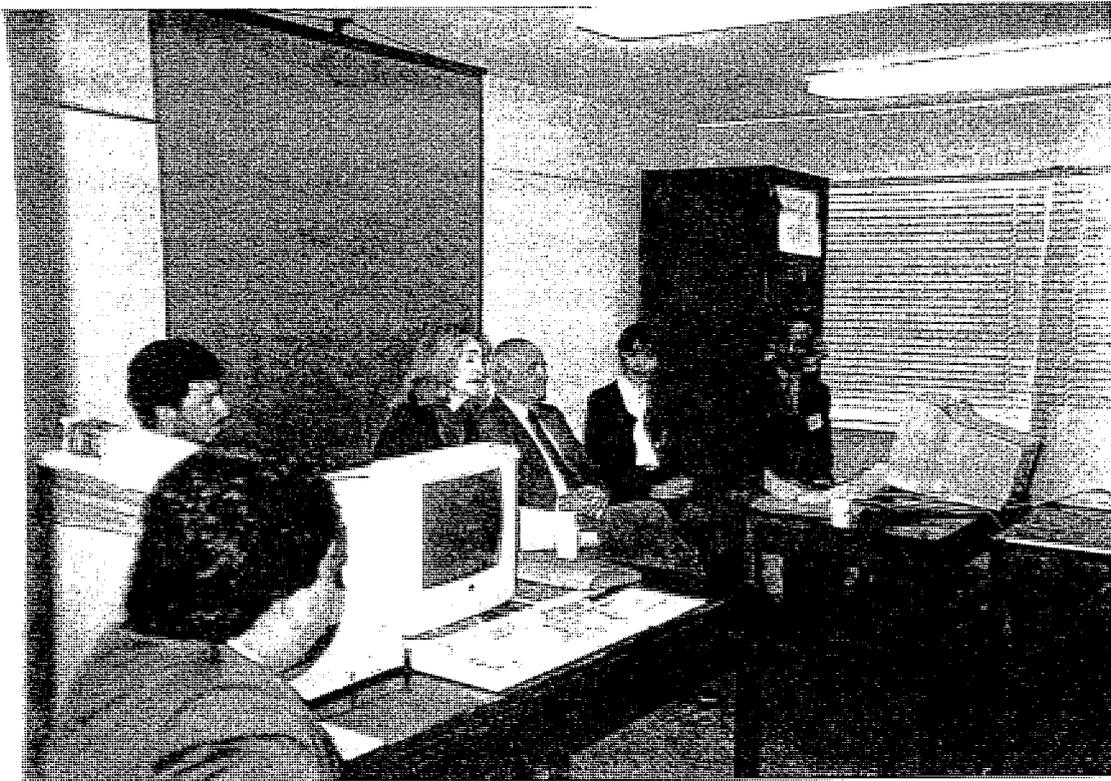
22

# ATTACHMENT 3

**SELECTED PHOTOGRAPHS TAKEN AT WORKSHOP:  
NEW TECHNOLOGIES AND STRATEGIES FOR ACCESSING  
AGRICULTURAL INFORMATION  
SANTIAGO, CHILE - OCTOBER 2-4, 1996**

COPIES OF ADDITIONAL ORIGINAL PHOTOGRAPHS AND NEGATIVES  
AVAILABLE TO USAID/UDLP UPON REQUESTS

24



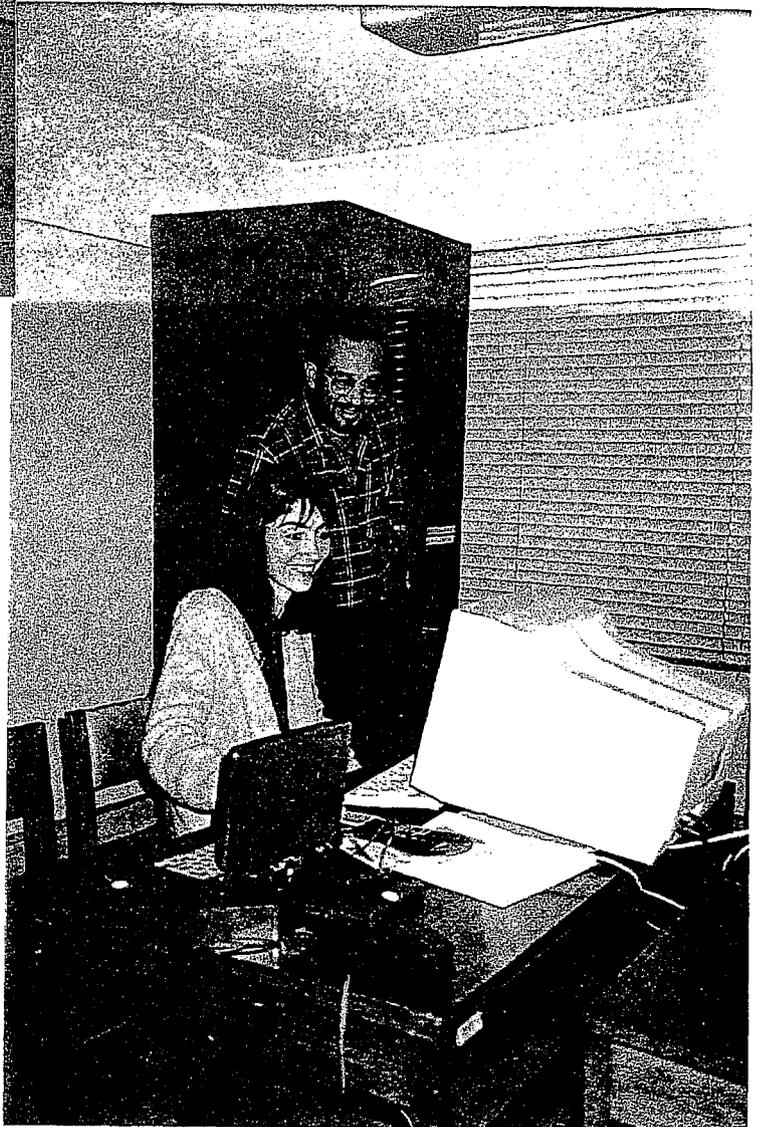
INTRODUCTIONS  
AND WELCOME



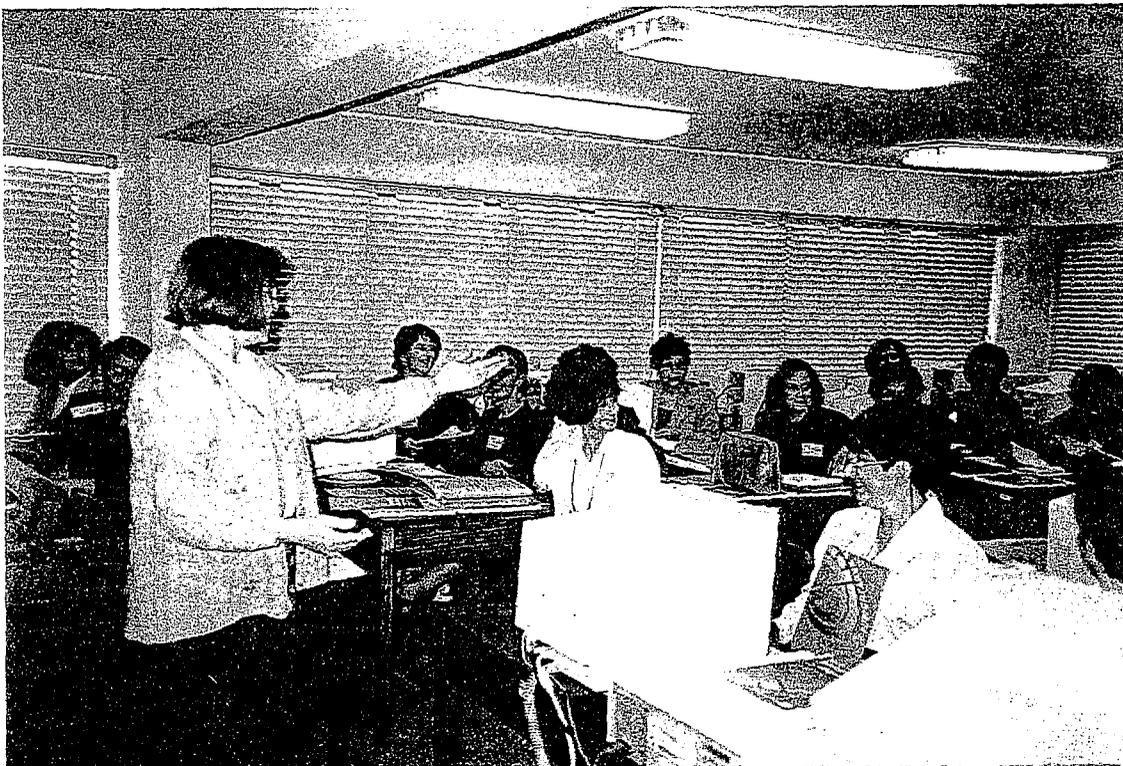
BARBARA HUTCHINSON,  
THE UNIVERSITY OF ARIZONA,  
(SECOND FROM RIGHT) AND CO-ORGANIZERS  
OF WORKSHOP

25

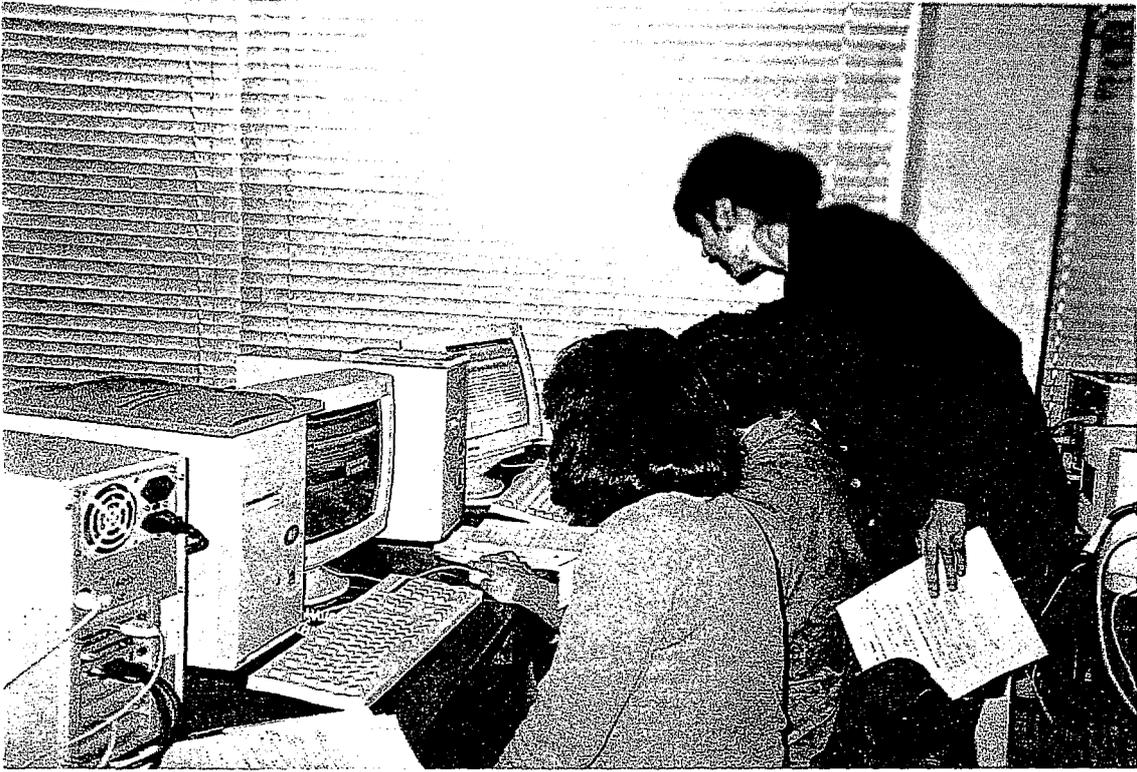
PROF. MANUEL ARROYO, PI, UDLP,  
"DEVELOPMENT OF SUSTAINABLE  
AGRICULTURE IN ARID REGIONS OF CHILE",  
UNIVERSIDAD DE CHILE, SANTIAGO, CHILE



LUZ MARINA ALVARE AND MARIANO MEJIA  
FROM CIAT, COLOMBIA, CHILE



GENERAL VIEWS OF WORKSHOP



HANDS-ON TRAINING



MARIANO MEJIA AND BARBARA HUTCHINSON



WORKSHOP PARTICIPANT GROUP



CLOSING CEREMONIES

# ATTACHMENT 4

Composition of methanolic extracts in aphid infested barley (*Hordeum vulgare*)

Prof. Juan Velozo S.  
Laboratorio de Fisiología Vegetal  
Facultad de Ciencias  
Universidad de Chile

May 1997

## Introduction.

The aphid infested barley, produce dangerous alterations that result in lowered productivity including the plant death. Some of biochemical effects observed includes decreasing of chlorophyll content, sugars and soluble proteins, photosynthetic efficiency and detention of the growth (Cassareto, J. 1996, Cabrera, M. 1994). One of the most important changes is the reduction of water potential in leaves and drought symptoms (Cabrera, M. 1994). This condition is the result of a drastic decrease of abscisic acid content (ABA). The reduction in the ABA content produces the loss of estomatic control and, therefore, the capacity of water retention in irreversible way. However, barley shows some defensives responses to the aphids attack: increasing of peroxidase activity and esterified phenols in the cell wall (Indarte, R 1995), induction of proteinase inhibitors (Casareto, J. 1996), increasing of phenyl ammonia liase activity (Veloza and Corcuera, 1996), and accumulation of soluble ferulic acid (Cabrera, M, 1994). These antecedents allow to establish two defensive strategies of aphid infested barley. First, limitation of the access of the aphid's mouth apparatus by hardening the cell wall. Second, discourage the insect attack, by production of deterrents and toxic compounds. Some of this compounds described as aphid deterrents are flavonoids (e.g., quercitin), which in feeding experiments, have showed to be both growth and reproduction inhibitors to aphids (Todd et al., 1971). Moreover, the ferulic acid has proven to be highly toxic to aphids (Cabrera, 1995).

The flavonoids and ferulic acid are derived of the fenilpropanoid pathway. The fenilpropanoids and their derived compounds have diverse functions, such as defensive factors to pathogen agents, attractive factors to polinizant agents, cell wall structure and protective agents against UV-B radiation injury (Hahlbrock& Scheel, 1989). The phenylalanine ammonia liase activity (PAL), is a key enzyme in the phenilpropanoid pathway, which catalyses the production of cinamic acid from phenylalanine (Harborne, 1982). PAL is mainly regulated by red light via phytochrome (Souders and McClure 1975) and different isoforms are expressed in different tissues during plant development (Liang et al., 1989). However, the PAL activity is modulated by light irradiation, temperature and nutritional condition (Hirai, et al., 1995).

Regarding the pathogens attack, it has been demonstrated that diverse isoforms of PAL are expressed in presence of fungus elicitors (Bolwell et al., 1985, Jorring & Dixon, Börner& Grisebach,

1982). Also, the activity of PAL could be induced for mechanic damage, as result of the herbivores or physical agents. In both case the increments of PAL activity is due to synthesis of novo and the expression of several isoforms (Ishizuka et al., 1991, Tanaka et al., 1989, Oosterhaven et al., 1995). Generally, the PAL activity increasing is faster by fungic elicitors than stimuli by mechanic damage. In relation to the induction of PAL activity in the aphid infested barley by *Schizaphis graminum*, has been demonstrated a negative correlation with the susceptibility level to the aphids, appearing as a bimodal kinetic of activity (Veloza and Corcuera, 1996).

In many studies about the interaction plant- insect, they show evidence indicating the importance of the phenols as mechanism of defence. For instance, with *Rhopalosiphum padi*, the feeding preference for a cultivar is associate to the level of phenol compounds in wheat (Leszczynski et al., 1985b). In wheat, the phenol content increases after the infestation, in both resistant and susceptible varieties plants, together with an increment in the activity of PAL (Leszczynski, 1985a, Ciepiela, 1989). Among the phenols compounds studied, the flavonoid shows an inverse correlation between their content and the preference of aphids in wheat's varieties (Nose et al.1985). This observation has been corroborated in feeding experiments (Jördens-Röttger 1979, Dreyer et al., 1981).

The above evidences allow to postulate a similar behaviour pattern between the wheat and barley in response to aphid infestation. A change in the composition of flavonoids in aphid infested plants, It would be modulated directly for a increase of the PAL activity. This enzyme would be implicated in the defensive machinery of the plant, and the products of their activity could have an deterrent effect to the aphids.

Thus, it was of interest to study some phytochemicals aspects of the aphid infested barley, mainly related to the flavonoids composition. Dr. Barabara Timmermann assistance was requested. She directs the laboratory of natural Products, of the Department of Pharmacology/ Toxicology of the University of Arizona.

In this work the proposals were: first, to know the change in the composition of flavonoids in infested plants in two varieties of barley, with a different level of susceptibility to the aphid *Schizaphis graminum*. In second, was interesting to study other chemicals changes in this system. Lastly, thinking to continue with this work in our laboratory, it was proposed to purify some of the compounds implicated in defensives strategies to characterise them for biological functions.

## Materials and Methods.

### *Plants:*

Barley seedlings, Libra and Frontera varieties were used, having different levels of susceptibility to the aphid *Schizaphis graminum*. Frontera varieties has lower susceptibility to the aphids attack and an higher induction of the PAL activity than Libra varieties (Veloza and Corcuera, 1997). The seeds were sowed in pots with vermiculite, grown in culture chamber to 25°C under a photoperiodic cycle of 14/ 10 (light/ darkness), and with a radiation of 40  $\mu\text{mol m}^{-2}\text{s}^{-1}$ . The plants were kept in hydroponics medium with Hoagland nutritious solution.

### *Aphids and Infestation :*

The aphids of the *Schizaphis graminum* specius were grown on plants of Frontera variety, under the same conditios described previusly. Plants of 10 days old were infested with 40 aphids/plant, during six days. The incubation conditions were the same described for their growth

### *The extracts:*

After six days of infestation, the leaves from healthful and infested plants were colected, approximately 500 g of fresh weight of each variety and condition. The leaves were pricked in a grinder and later were extracted exhaustively in methanol, three times for 24 h. The methanolic extracts were evaporated under reduced pressure and finally dried and stored until their analysis.

### *Analysis of the patterns by means of TLC:*

Initially, 1 g of extracts (F001) was taken, and fractionated in distilled water, 100 ml. Then, the water soluble fraction was filtrated and the residual material was solubilized in ethyl acetate. Both fractions (F002 and F003 respectively, see Fig. 1), were evaporated in order to analyse them by TLC. To verify the presence of flavonoids, the water fraction (F002) was separated by TLC in plates of cellulose (1D), BAW was used as solvent of elution (n-BuOH, acetic acid, water, 40: 10: 50). The chromatographic plate was revealed for exposition to ultraviolet light (UV) and with 2-aminoetil diphenylborato (NA). The same sample was analyse by TLC of reverse phase (RP), the eluent was acetonitrile 60%, and the plates were revealed with UV light and with the anisaldehyde reagent. The water insoluble fraction

(F003) was separated by TLC of silica Gel (1D) with the mixture CHCl<sub>3</sub>, MeOH, H<sub>2</sub>O (65: 25: 10) and also with 10% ethyl acetate / hexane. The chromatographic plates from fraction F003 were revealed by means of UV absorption and anisaldehyde reagent. Finally, fraction F002 was fractionated again with acetone in order to separate a "pink spot", this compound appeared only in RP-TLC from *Libra* infested plants while in *Frontera* varieties it is present in healthful and infested plants. This compound showed to be a highly acetone soluble material. Thus, the fractions F004 (acetone soluble) and F005 (acetone insoluble) were obtained.

*Purification and identification of flavonoids and other compounds that appear in the extracts of infested plants:*

Flavonoids and the pink spot were isolate from 5 g of each F001 fraction. Previously, they were fractionated as it was indicated above, then they were obtained from the fraction F004 and F005 (pink spot and flavonoids respectively). These compounds were separated in silica gel and reverse phase columns, with a flash column system or medium pressure system (MPLC), respectively. The sephadex LH20 columns was used, too. The specific CC system is detailing in results, in all the cases the elutions were scaling by changing the polarity from water to methanol. Each elution was fractionated and analyzed by TLC. The purified compounds were analyzed in HPLC, with a RP column 18 Lycrosphere (5 µm particle, 250\* 4.6mm). In some cases, the compounds were purified by this same system, using a RP preparative column. The identification of the isolated material was carried out by mass spectrometry (MS), HNMR, C<sup>13</sup>NMR and infrared spectrometry (IR). Finally, the isolated compounds were used as standard for their quantification in the original extracts, by HPLC system.

**Results.**

The methanolic extracts from infested plants showed an increase of mass respect to the healthful plants, in both varieties, however, *Frontera* varieties had an higher increase of mass than *Libra*. The methanolic extract in infested plants represent 4.2% of fresh weight, while in the healthful plants, only 3.3% (Table 1). The TLC analysis allowed to establish three important observations. First, in the fraction F002 (water soluble) appeared 3 flavonoids, , these could be flavones according to their colorimetric reaction with 2-aminoethyl diphenylborate. However, they not showed significant differences between healthful and infested plats, in both varieties. Only one spot of possible flavones had higher intensity of reaction,

while the other were very slight. In RP-TLC from fraction F002 appeared a pink spot, which was very intense in the Frontera varieties, so much in healthful plants like infested, while in Libra varieties was evident only in the infested plants. Finally, in the fraction F003 (water insoluble) appeared four spots, only in the infested plants. This fraction would meet a series of aliphatic and alicyclic compounds, which all of them they are produced under the infestation by aphid in barley plants (Cabrera et al, 1995). Regarding these results, we decided to follow the analysis with the water fraction, because this fraction represented the 80% of the crude extracts.

#### *Gramine:*

The result of RP-TLC from F002 fraction, which was revealed with anisaldehyde showed a pink spot. This spot only appeared in the pattern of Libra infested plant and showed to be highly soluble in acetone (F004), which allowed to isolate it from the fraction F002. Pink spot was purified from FI-F004 fraction (Frontera infested), by MPLC with a RP column 18 (15- 25  $\mu\text{m}$  MN-Polyoprep of 2,6\* 46 cm). The column was eluid with 4 L of the mixture acetone: MeOH: H<sub>2</sub>O (40: 40: 20), 100 ml fraction were collected. The fractions 15 to 25 was mixed and evaporated, obtaining 42 mg, which was utilized for their identification. According to HNMR, C<sup>13</sup>NMR, MS and IR spectra, was determined the pink spot structure, this resulted to be the gramine. The alkaloid was quantified in the original extracts by HPLC, using a column RP18, the mobile phase H<sub>2</sub>O: ACN: EtOAc: H<sub>3</sub>PO<sub>4</sub> (86: 13: 1.5: 1), with a flow of 1ml/ min. and UV detector to 254 nm. using epi-galo-catequin-galey (EGCG) as external standard. Gramine and EGCG appear at 6.8, 10.5 and 14 minutes in the chromatogram. The gramine content in the Frontera varieties was three time greater than Libra varieties. In Frontera varieties not showed significant differences in the level of gramine between the infested patterns and controls, while in infested Libra varieties the level of this compound was 2.5 fold higher than the control.

#### *Lotaustraline:*

The HPLC analysis of the purified fractions by RP-MPLC from FI-F004 showed a pick that not was found in the control sample. The same observation was repeated in Libra varieties, which woke up the interest by determining their composition. This compound was purified from FI-F004 fraction by HPLC. The purified material was analyzed by HNMR, and C<sup>13</sup>NMR spectra. The following structure was determinated: glu-OC (CH<sub>3</sub>) 2-CH<sub>2</sub>-CN. This structure remained the cyanogenic glycoside

Lotaustraline (Dey and Harborne, 1997), which is derived from the isoleucine. However, this kind of compounds could not be detected for UV absorption, the methodology that was used for its isolation, for this reason it was decided to analyze the infrared spectra of F004's fractions. The IR spectra of all F004 fractions (2 mg) showed that this compound only appears in the Frontera varieties, with the same level in the infested like in the healthful plants. According to this evidence the Lotaustraline would represent an important difference between the barley varieties.

#### *Saponarine:*

The flavonoid that showed greater intensity in cellulose TLC was obtained from FI-F005 fraction (Frontera infested). This was purified by MPLC system, with a RP-18 column. The column was first washed with water in order to remove the sugars and salts (fraction F006), then with ACN 50%, obtaining the fraction F007, that finally was evaporated. In this fraction was retained most of the flavonoids, then this material was separated by a LH20/ MeOH column, and finally crystallized in water. It was obtained 120 mg., this showed a 95% purity by HPLC. This compound was analyzed by means of APCI-MS and MS-MS, and it was identified as saponarine. The content of saponarine in original extracts was carried out by HPLC, with the same elution developed for gramine. The saponarine content was 20% higher in Frontera infested sample than control, while in Libra had a 50% of increase.

#### **Discussion.**

Some authors have described a negative correlation between the susceptibility of barley to the aphid attack and the gramine level in leaves (Zuñiga et al, 1985, Kanehisa et al, 1990, Rustamani et al, 1992). The abundance of gramine changes significantly in the barley varieties, diminishes with the age of leaves and under infestation by aphids (Kanehisa et al, 1990). In feeding studies have been demonstrated that this compound is highly toxic for the aphids, it produces a significant decrease in both reproductive and survival rate (Zuñiga et al, 1985, Corcuera, 1993). However, the level of gramine could be increased when the plants are exposed to an increase of the photoperiodic cycle (hours of light) or temperature (Salas and Corcuera, 1991). These antecedents allow to establish that gramine would be a constitutive strategy in order to limit the aphids attack. Contrarily, we have found in Libra varieties that gramine

showed a significant increment of 2.5 fold in infested plants, although it was three fold lower than the observed in Frontera varieties (variety less susceptible to the aphid). This result is a very important phenomenon of inducibility, which has not been described previously and could represent an important defensive strategy in barley.

In Frontera varieties was found the presence of lotaustraline, this is a cyanogenic glycoside derived from isoleucine (Conn, 1980).

The lotaustralina appeared only in Frontera varieties, in infested and healthful plants, but it not showed significant differences between the samples. The production of cyanogenic glycosides represent an important and effective defensive strategy of the plants to the herbivores. These compounds are accumulated in the vacuols of epidermic cells. When an herbivore bites or harms the leaves, these compounds are liberated, taking contact with  $\beta$ -glucosidases in the mesophil cells, which resulted in the 2- hidroxinitriles production. Later these reaction with hidroxinitrile liase enzyme, resulted in the production of HCN. The HCN is highly toxic for animals, because interferences the electronic transport in the mitochondrial respiration (Dey and Harborne, 1997). When the level of cyanogenic glycosides is high could to result in the death of the predator. Also the cetonics or aldehydes derived of the 2- hidroxinitrilos have demonstrated to be deterrent for insects. However, the plants could reduce the toxicity of CN, by an alternative respiration, resistant to CN (Siedow and Berthold, 1986). The presence of lotaustraline in the Frontera varieties, it would be one of many factors determining the low susceptibility of this variety to the aphids.

Saponarina was found as the principal flavonoid present in the barley extracts, in infested and healthful plants in both varieties. The C- flavones, saponarine and lutonarine represent the principal flavonoids in the leaves of barley, when they are grown in land (Seikel and Bushnell, 1959, Seikel et al, 1962), while in greenhouse or culture chamber conditions just saponarina is present, this is due apparently to high radiation necessity for lutonarine synthesis (Seikel and Bushnell, 1959, Dietz, et al, 1994), this antecedent is in agree with our results. Also, has been demonstrated that the synthesis of both flavonoids is under both red light and UV radiation control (McClure and Wilson, 1970, Liu, et al, 1995). In our system, saponarina increasing in both varieties under infestation condition. However, the higher increasing was observed in Libra varieties, 50% over, while in the Frontera variety was observed a 20% of increment. Previously, we have demonstrated an important increasing of PAL activity in infested plants (Velozo and Corcuera, 1996). These result support the hypothesis of that as a result of

the increase of PAL activity and flavonoid content increases. However, the increasing of saponarine was not proportional to the level of PAL activity under infestation, which reaches a 300% in the variety Frontera. This apparent contradiction could reflect different strategies between the analyzed varieties. A possibility is that the synthesis of saponarine is not perfectly matched to the increasing of PAL. Another possible explanation is that other routes of the phenylpropanoid pathway are being activated, as the synthesis of lignin, suberin or esterified phenols of cell wall.

### **Projections:**

The results of this work are very important, they will allow to develop three lines of research in the short time. First, to determine the magnitude of gramine induction under infestation, and the effect of this increasing for aphids feeding behavior in Libra varieties. Second, to determine the function of the cyanogenic glycoside lotaustrina, in the defensive strategies in the Frontera varieties by feeding experiments. Finally, it will be very important to establish the toxicity of saponarine for the aphids. Also, we have interested in to study other routes of the phenylpropanoid pathway, that could be activated by aphids, as lignin synthesis. This information will permit a much better approach to the defensive systems in barley to aphids attack.

### **Acknowledgments.**

This work was supported by the cooperation project "Development of Sustainable Agriculture in Arid Regions of Chile" between the University of Arizona and the University of Chile. I would like to thank to the Dr. Barbara Timmermann for her help during my work in her laboratory. Also to Dr. Gerald Waechter, for his valuable collaboration in this study. Finally to the Dr. Manuel Arroyo, Coordinator of the project Arid Zones in Chile.

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Figure 1. Fractionation of crude extracts of barley

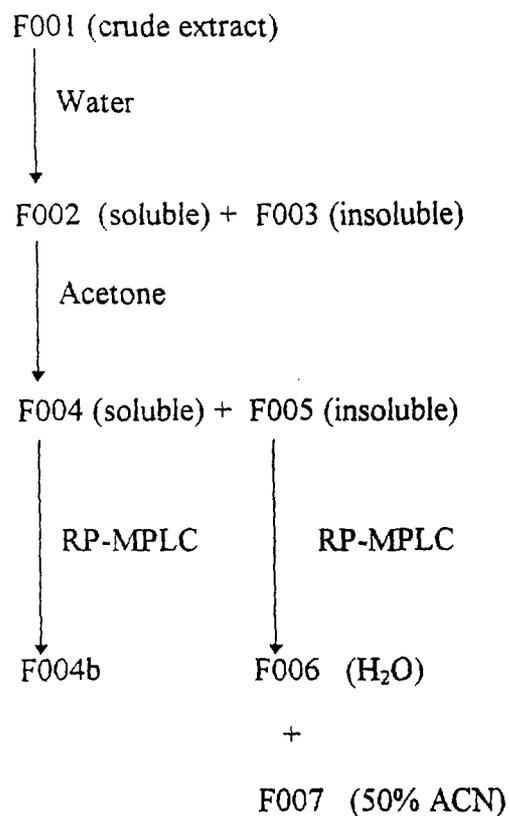


Table 1.- Weights of methanolic extracts obtained in leaves of barley of 16 days old plant.

Material/ variety	Fresh weight (g)	Weight extracted material (g)	% extracted
Frontera Infested	684	28.6	4.2
Frontera healthful	785	25.7	3.3
Libra Infested	345	11.0	3.2
Libra healthful	468	14.1	3.0



# Tierras Aridas

## CONEXIONES

DEVELOPMENT OF SUSTAINABLE AGRICULTURE IN ARID REGIONS OF CHILE

VOLUME 3, NUMBER 1

### Chile Linkages Project Status Report

Dr. Barbara Timmermann and Prof. Manuel Arroyo attended the University Development Linkages Project (UDLP) International workshop in Arlington, Virginia, October 16–18, 1995. A poster session was presented with the objectives, main activities, and accomplishments of the project. Linkage efforts likely to strengthen the outreach activities of this UDLP were initiated with a similar arid land project in Jordan in which Washington State University is the U.S. collaborating institution. Also discussed, with participants from Arizona State University, Tempe, Arizona, was the possibility of incorporating some aspects of agribusiness in arid land management. Similar discussions were held with members of other UDLP projects, such as the Community Colleges project and the one sponsored by Cornell University in Central America.

The candidate for graduate education at the University of Arizona (UA) was competitively selected by the University of Chile (UCH) committee chapter of the UA-UCH project. The candidate was proposed to the UA graduate college and his records were reviewed by the Arid Land Resource Sciences Executive Committee. The candidate was accepted unanimously based on his credentials to initiate the Ph.D. program during the Spring Semester 1996, which started January 11, 1996. The selected candidate is Mr. Alejandro León Stewart, a faculty member of the Department of Rural Development, Faculty of Agriculture and Forestry Sciences, UCH, and Mr. León Stewart obtained official permission from his UCH academic unit for undertaking the Ph.D. program at the UA.

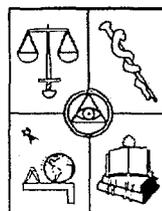
The UA modular course in watershed management is under active consideration for possible delivery during 1997. A related initiative, sponsored by the Corporación Nacional Forestal (CONAF), took place in Chile in January 1996. This activity will lead toward the involvement of further support for the proposed course in collaboration with the UA. It is very important to seek a larger audience of public service professionals in order to multiply the knowledge in watershed management to be offered by specialists of the University of Arizona.

Efforts to obtain public funding in Chile to conduct research in the Limari River watershed have come to a halt due to the extreme drought in Region IV. In spite of the drought, the proposed research on the analysis of agriculture production systems and utilization of natural resources in the Limari River watershed started in August 1995. This project is ongoing, and it is scheduled to be completed by the end of 1996. UA assistance and consultations through the Arid Lands Information Center (ALIC) will be sought in order to expand the review of the subject matter and the methodology available in the current bibliography. This activity will be pursued as soon as the first steps of this research are evaluated later this year.

*Status Report next page* ⇨

THE UNIVERSITY OF ARIZONA AND UNIVERSIDAD DE CHILE ARE COMMITTED TO DEVELOPING A LONG-TERM COLLABORATIVE LINKAGE IN ARID AND SEMI-ARID ECOSYSTEMS FOR THE DEVELOPMENT OF SUSTAINABLE AGRICULTURE. THIS FIVE-YEAR PROJECT, AWARDED BY US AGENCY FOR INTERNATIONAL DEVELOPMENT (USAID) UNDER THE UNIVERSITY DEVELOPMENT LINKAGES PROJECT (UDLP), CONNECTS BOTH UNIVERSITIES' COMMON INTERESTS TO PROMOTE SUSTAINABILITY, NATURAL RESOURCES MANAGEMENT, INSTITUTIONS AND HUMAN RESOURCES IN CHILE.

PROJECT DIRECTOR  
BARBARA N. TIMMERMANN, PH.D.  
UNIVERSITY OF ARIZONA  
OFFICE OF ARID LANDS STUDIES  
TUCSON, ARIZONA 85719  
USA  
PHONE: 1 (520) 626-2481  
FAX: 1 (520) 626-4063  
E-MAIL: BTIMMER@TONIC.PHARM.ARIZONA.EDU



PROJECT CO-DIRECTOR  
MANUEL ARROYO, M.S.  
UNIVERSIDAD DE CHILE  
PROGRAMA DE ZONAS ÁRIDAS  
DIAGONAL PARAGUAY 265, OFICINA 1701  
TORRE 15, PISO 16  
SANTIAGO, CHILE  
PHONE: 56 (2) 678-2019  
FAX: 56 (2) 678-2120  
E-MAIL: TIRIARTE@UCHDCIUX.SECI.UCHILE.CL

## Status Report

Continued previous page

ALIC organized a three-day workshop in Spanish titled *From Research to Market: Accessing Agricultural Information*, for 30 participants from organizations and institutes throughout Chile on how to access research and business-related agricultural information, with a special focus on the needs of the South American agricultural community. Facilities at the UCH will be used for the workshop, and two facilitators from CIAT in Colombia will moderate it.

UCH's Arid Lands Program (ALP) has been invited to participate as part of a newly established Committee for assisting the Chilean Government authorities in organizing the implementation of the National Plan of Action to Combat Desertification. Professor Manuel Arroyo presented the proposal for establishing a new institutional setup for the implementation of the Plan of Action at a workshop organized by CONAF and attended by members of this Committee and selected participants from public institutions and NGOs at the University of Chile, December 19–20.

An evaluation of the UCH/ALP co-sponsored IV International Course in Arid Lands offered by the Graduate College, Montecillo, Mexico, and financed by UNEP/FAO, took place at the Regional Office of FAO with the attendance of Dr. Enrique Leff from the Mexico Regional Office of UNEP. It has been requested that the ALP prepare the program for the V International Course in Sustainable Development and Desertification to

be delivered by the University of Chile. The course will be partially funded by UNEP, with some contributions from the FAO Regional Office in Chile and will take place during the last quarter of 1996.

### Other UDLP News

The following has been drawn from the fifth issue (Summer 1996) of *Linkage Lines*, the newsletter of USAID's UDLP.

- The University of Iowa, Iowa State University, the University of Northern Iowa, and the Des Moines Community College System are linked with four Nigerian institutions through the UDLP: the University of Ibadan, Obafemi Awolowo University, the Nigerian Institute for Social and Economic Research, and Polytechnic Institute of Ibadan. These participants have been working in a variety of disciplines, including geography, computer science, communications, anthropology, urban planning, and economics. In spite of much reduced funding by USAID, the participants are continuing their connections through other funding sources and through e-mail connections.
- The linkage between Utah State University and the Institut Agronomique et Veterinaire Hassan II in Morocco has actively used telecommunications to enhance agricultural extension and education, including research in women's roles in natural resource management, developing software for managing water resources, desert sheep nutrition, and social science research on water pricing and

management. The telecommunications component seeks to enable the Moroccan Agronomy and Veterinary Institute to extend its resources throughout Morocco by linking the main Rabat campus with its 32 extension centers across the country. This project follows on the success of a similar project Utah State University did with the University of Quito, Ecuador.

- Purdue University and the Instituto Tecnológico y de Estudios Superiores de Monterrey (ITESM) are collaborating to trade undergraduate courses in their own language via satellite during the fall 1996 semester. The Purdue course is *Introduction to the Internet and the World Wide Web*. The course by ITESM is *Socio-Cultural Values of Mexico and Latin America*.
- The Educational Leadership Network (EL NET) has been developed by the Mexican Association for International Education, the Western Interstate Commission for Higher Education, the University of Arizona, and the Universidad Autónoma de Baja California. EL NET is a broadcasting and networking tool for college and university presidents, rectors, and other campus administrators; educational policymakers; comparative education researchers; representatives of foundations; corporate sector leaders and representatives of industry associations; and students and faculty—all who are committed to fostering North American educational exchange. <http://www.wiche.edu/elnet/home.htm>

## FACULTY INTERESTS

### Alejandro León Stewart

Alejandro León is a graduate student from Chile in the Arid Lands Resources Sciences Ph.D. Program since January. He plans to complete the Development Track in that program. Once he completes his program of studies and returns, he plans to join the researchers involved in arid zones programs to create and develop new approaches to solving the problems currently affecting the inhabitants and natural resources within the area, one of the poorest of his country.

He graduated from the University of Chile as an Agricultural Engineer in 1985, and since then has worked as a teacher (appointed as Assistant Professor in 1995) and researcher in the Faculty of Agriculture and Forestry Science, Department of Rural Development. His teaching activities have been related to Planning, International Trade, and Business Administration courses. He has also acted as an advisor for undergraduates' thesis work.

He has attended several post graduate courses, including "Vegetable Production in Egypt" (1989), "Food Supply and Policies" (1989), "Development, Planning and Public Policies" (1990), and most recently, a two year executive Business Administration course (1992-1994). In addition to this coursework, he has been involved with other faculty members in several research projects such as "International Trade of Seeds among Countries of the Southern Cone of South America", "Exports of Frozen Foods and Vegetables", "Harvest and Handling Improve-

ment of Mango for Export Markets", and "Improvement of Postharvest Handling of Horticultural Products", financed by international or Chilean agencies.

He has also developed technical studies for the Chilean Government (Foreign Investment Opportunity Analysis in the Chilean Tourism Sector) and the United Nations Industrial Development Organization (Technical Assistance Program for the Private Agroindustry).

As a result of his research activity, he has published and presented several papers in Congresses, Annual Meetings, and Seminars, in Chile and abroad.

As a professional, he has been involved with the private agribusiness. Between 1984 and 1986, he worked at a fruit exporting company, his job being related to export operations of grapes, peaches, nectarines, and plums. After that, he was a farm advisor for fruit growers oriented to the international markets (1986-1988) and the manager of the Seed division of a Chilean company that was a subsidiary of Ferry Morse, an American vegetable seed company. During the last four years, he was appointed as the general manager of a producing company that owns a 1,000 acre ranch near Santiago, Chile's capital city, where they raise cattle, produce hybrid and O.P. seeds, fresh vegetables, and most recently, roses grown in heated greenhouses and oriented to the local market.

### Ximena Vargas

Ximena Vargas has been involved in the following activities:

- Participated in a seminar on drought organized by the Chilean Committee of PHI.
- Coinvestigator of Project Fondecyt "Currents of Debris in Central Chile: Hydrometeorological-hydraulic Focus on the Problem" which resulted in an investigative group of the División Recursos Hídricos y Medio Ambiente del Departamento de Ingeniería Civil de la Universidad de Chile.
- Facilitator for the study "Natural Resources and the Sustainability of Growth in the Chilean Agrarian Sector." by a work group from the Facultad de Ciencias Agrarias y Forestales.
- Assisted the lecture by collaborator professor R. Bales from UA on General Water Management on 9 October 1995.
- Principal Investigator for the project "Analysis of Hydrologic Criteria for Managing Water Resources: Guidelines for Determining Flow Rates" which was presented by the División Recursos Hídricos y Medio Ambiente del Departamento de Ingeniería Civil de la Universidad de Chile for the Dirección General de Aguas, Ministerio de Obras Públicas.
- Currently planning a study for Fondef with participation of two professors from the University of Arizona: Charles Gerba, from the Soils and Water Department, and Robert Arnold, from the Department of Chemical and Environmental Engineering.

# INFORMATION RESOURCES

## Print

Food and Agricultural Organization. Office for External Relations. 1994. *Sustainable Agriculture and Rural Development. Part 1: Latin America and Asia*. FAO Development Education Exchange Papers. Rome: FAO.

## Electronic

**Sustainable Development Dimensions**, a service of the Sustainable Development Department (SD) of the Food and Agriculture Organization of the United Nations (FAO), was created in January 1995. It focuses on four key dimensions of sustainability: people's participation and mainstreaming of women in development; agrarian transformation; research, extension and education; and natural resource monitoring and management. FAO Sustainable Development Department (SD), Food and Agriculture Organization of the United Nations (FAO), Viale delle Terme di Caracalla, 00100 Rome, Italy.

[http://www.fao.org/waicent/faoinfo/sustdev/welcome\\_.htm](http://www.fao.org/waicent/faoinfo/sustdev/welcome_.htm)

**Center for Sustainable Development in the Americas (CSDA)** is a private non-profit organization based in Washington D.C. Their mission is to promote sustainable development in Latin America and the Caribbean by: furthering innovative financing mechanisms which promote sustainable development; establishing strategic connections, especially those which engage the private sector, which facilitate the transition toward regional sustainable development; enriching the international environ-

mental and sustainable development policy dialogue; informing the international community about Latin American and Caribbean efforts to move toward a sustainable society.

<http://www.ji.org/jinews/csda/csda.htm>

**Florida Internet Center for Understanding Sustainability (FICUS)** was formed to produce a high quality multimedia educational resource and communication forum that integrates issues relating to development, ecosystems, and conservation under a common theme of sustainability.

<http://www.arch.usf.edu/ficus/default.htm>

**Business Council for Sustainable Development-Latin America (BCSD-LA)** was created following the 1992 Rio Conference as a regional partner of the BCSD global network. In March 1995, the BCSD-LA formalized its status as a partner association of the World Business Council for Sustainable Development (WBCSD). With the active participation of business leaders in Latin America, the BCSD-LA operates through several task forces. Currently work is being done in the areas of promotion of eco-efficiency principles in small business, sustainable infrastructure, education and training, environmental policy development, joint implementation, nature conservation, and policy creation for sustainable development. BCSD-Latin America Secretariat, Avenida Eugenio Garza Sada 2501 Sur, ITESM, Edificio CEDES 6th Floor, 64849 Monterrey, Nuevo Leon, Mexico, Tel: +52 (8) 328 4186 /

Fax: +52 (8) 328 4185. E-mail: [bcstdla@campus.mty.itesm.mx](mailto:bcstdla@campus.mty.itesm.mx).

<http://www.sistema.itesm.mx/misc/bcsd-la/bcsd-la.htm>

**Programas de Desarrollo Regional Sustentable (PRODERS)** se desarrollan actualmente en 14 regiones del país y su desarrollo está a cargo de la Dirección General de Programas Regionales, Subsecretaría de Planeación, Secretaría del Medio Ambiente, Recursos Naturales y Pesca. En breve se podrá consultar información sobre los Programas de Inversión para 1996.

**Sustainable Sources.** The purpose of Sustainable Sources is to provide a solutions-based environmental site. It has links to sites with information on sustainable building, articles on sustainability, etc.

<http://www.greenbuilder.com/>

**The Rural Advancement Foundation International (RAFI)**. RAFI is an international non-governmental organization headquartered in Ottawa, Ontario (Canada) with affiliate offices in Pittsboro, North Carolina (USA). RAFI is dedicated to the conservation and sustainable improvement of agricultural biodiversity, and to the socially responsible development of technologies useful to rural societies. RAFI is concerned about the loss of genetic diversity—especially in agriculture—and about the impact of intellectual property rights on agriculture and world food security. RAFI, 71 Bank St., Suite 504, Ottawa, Ontario K1P 5N2, CANADA. Tel:

*Information Resources next page* ⇨

## OTHER NEWS

### Conferences

#### Past

8–11 July 1996. *New Crops, New Products: New Opportunities for Australian Agriculture*. First Australian New Crops Conference, The University of Queensland Garron College, Australia. Contact: First Australian New Crops Conference Secretariat (Sally Brown), Continuing Education, The University of Queensland, Australia 4072. Phone: +61 (7) 3365-6360. Fax: +61 (7) 3365-7099. Email: Sally@ceu.uq.oz.au.

11–14 September 1996. *Visión para las Américas*. First International Conference on Natural Resources and Cultural Heritage. New Mexico State University (NMSU), Las Cruces, New Mexico. Sponsored by the Bureau of Land Management (BLM) and the Hispanic Association of Colleges and Universities (HACU). Contact: Alice Barrios, Border Research Institute. Phone: +1 (505)

646-3524. Fax: +1 (505) 646-5474.

#### Future

3–5 April 1997. *The Information Frontier: Linking People and Resources*. A joint conference sponsored by the United States Agricultural Information Network (USAIN) and International Association of Agricultural Information Specialists (IAALD), Holiday Inn City Center, Tucson, Arizona, USA. Contact: Debra L. Currie, LSU Libraries, Louisiana State University, Baton Rouge, LA 70803. Phone: +1 (504) 388-8538. Fax: +1 (508) 388-6992. E-mail: notdlc@lsuvm.sncc.lsu.edu.

12–16 May 1997. *Combating Desertification: Connecting Science with Community Action*. Sponsored by United States Department of the Interior Bureau of Land Management, and the International Arid Lands Consortium. Contact: Beaumont C. McClure, Bureau of Land Management, Arizona State Office, P.O. Box

16563, Phoenix, AZ 85011-6563. Phone: +1 (602) 650-0206. Fax: +1 (602) 650-0398. E-mail: bmclure@attmail.com.

30 September–2 October 1996. *The Hemispheric Congress on Disaster Reduction and Sustainable Development*. This will bring together a selected group of about 200 key stakeholders from public, private, and international organizations to formulate a series of policy initiatives supporting disaster reduction and sustainable development in the Americas.

<http://www.fiu.edu/~hurricane/congress/congress.html>

December 1996. *Summit on Sustainable Development*. Leaders from the western hemisphere will gather in Santa Cruz, Bolivia for a follow-up to the historic 1994 Summit of the Americas. A calendar of events will be placed on AmericasNet as soon as it is available.

<http://americas.fiu.edu/>

### Information Resources

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(613) 567-6880. Fax: (613) 567-6884. E-mail: rafican@worldlink.ca.

<http://www.charm.net/~rafi/rafihome.html>

**Division for Sustainable Development (DSD)**. The mission of the DSD is to make a contribution to achieving sustainable development worldwide by facilitating implementation of Agenda 21, the Rio Declaration on Environment and Development, the Non-legally

Binding Authoritative Statement of Principles for a Global Consensus on the Management, Conservation and Sustainable Development of All Types of Forests (also known as the Forest Principles), and the Global Programme of Action for Sustainable Development of Small Island Developing States (SIDS). United Nations, Department for Policy Coordination and Sustainable Development, Division for Sustainable Development, United Nations Plaza, Room DC2-2270, New York, NY 10017 USA. Tel: +1 (212) 963 3170. Fax: +1 (212)

963 4260. E-mail: dpcsd@un.org.

<http://www.un.org/dpcsd/dsd/>

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<http://www.mother.com/agaccess/Welcome.html>

**Tierras Aridas**  
**CONEXIONES**



DEVELOPMENT OF SUSTAINABLE AGRICULTURE IN ARID REGIONS OF CHILE

VOLUME 3, NUMBER 1

**Tierras Aridas** is interested in your ideas for resources or information that would be of interest to other project participants. If you would like to make contributions, send them to the editor:

Michael Haseltine  
Arid Lands Information Center  
The University of Arizona  
1955 E. 6th Street  
Tucson, Arizona 85719-5224  
Telephone: (520) 621-8576  
FAX: (520) 621-3816  
haseltin@ag.arizona.edu

**Tierras Aridas**  
Michael Haseltine, Editor  
Arid Lands Information Center  
1955 E. 6th Street  
Tucson, Arizona 85719-5224

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# Tierras Aridas

## CONEXIONES

DEVELOPMENT OF SUSTAINABLE AGRICULTURE IN ARID REGIONS OF CHILE

VOLUME 3, NUMBER 2

### Chile Linkages Project Status Report

#### Develop institutional capabilities for education and research

The Universidad de Chile (UCH) and The University of Arizona (UA) faculty participated in two significant events during the last quarter of 1996. Dr. Donald Nelson from the UA offered a presentation at the Annual Meeting of the Sociedad de Biología, Vina del Mar, Chile in early October on the present status of research on transgenic plants adapted to saline and arid environments. The meeting was also attended by the PI/PD, Dr. Barbara Timmermann, who presented the results of her research in Chile.

The second event, the course/workshop on *New Technologies and Strategies for Accessing Agricultural Information*, was jointly organized by UA Arid Lands Information Center (ALIC) and the UDLP Project with input from the UCH Sistema de Servicios de Información y Bibliotecas (SISIB) and the Agronegocios Center (CIE). Ms. Barbara Hutchinson from ALIC organized this event, considered very successful and useful for librarians and information specialists attending the course (See the report starting on p. 3). During the opening ceremony of the workshop, Soledad Ferreiro, Director of SISIB, Barbara Hutchinson, and professor Manuel Arroyo addressed the 33 Chilean participants. The substantive training was delivered by specialist consultants from the Centro de Agricultura Tropical (CIAT), Colombia.

UCH's graduate student, Alejandro León, completed the second semester of studies towards his Ph.D. work at the UA. He is at present registered for the Spring semester of 1997.

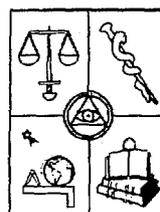
As a result of steps taken to identify innovative paths to develop the institutional capabilities at the UCH in connection with this UDLP, Professor Claudio Meneses completed a research proposal for discussion with UA counterparts in order to review its submission for funding to external agencies. He is expected to spend a period of faculty exchange at the UA from July–September 1997. More initiatives of this type are expected to be developed during 1997.

The three UCH researchers selected to go to the UA to work for a short-period (up to three months) under the guidance of UA professors, have been organizing their respective materials and background information. These young scientists are expected to qualify for becoming UCH faculty once the process of UCH reorganization allows them to be hired on a permanent basis. The selected researchers to train at the UA are:

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THE UNIVERSITY OF ARIZONA AND UNIVERSIDAD DE CHILE ARE COMMITTED TO DEVELOPING A LONG-TERM COLLABORATIVE LINKAGE IN ARID AND SEMI-ARID ECOSYSTEMS FOR THE DEVELOPMENT OF SUSTAINABLE AGRICULTURE. THIS FIVE-YEAR PROJECT, AWARDED BY US AGENCY FOR INTERNATIONAL DEVELOPMENT (USAID) UNDER THE UNIVERSITY DEVELOPMENT LINKAGES PROJECT (UDLP), CONNECTS BOTH UNIVERSITIES' COMMON INTERESTS TO PROMOTE SUSTAINABILITY, NATURAL RESOURCES MANAGEMENT, INSTITUTIONS AND HUMAN RESOURCES IN CHILE.

PROJECT DIRECTOR  
BARBARA N. TIMMERMANN, PH.D.  
UNIVERSITY OF ARIZONA  
OFFICE OF ARID LANDS STUDIES  
TUCSON, ARIZONA 85719  
USA  
PHONE: 1 (520) 626-2481  
FAX: 1 (520) 626-4063  
E-MAIL: BTIMMER@PHARMACY.ARIZONA.EDU



PROJECT CO-DIRECTOR  
MANUEL ARROYO, M.S.  
UNIVERSIDAD DE CHILE  
PROGRAMA DE ZONAS ÁRIDAS  
DIAGONAL PARAGUAY 265, OFICINA 1701  
TORRE 15, PISO 16  
SANTIAGO, CHILE  
PHONE: 56 (2) 678-22168  
FAX: 56 (2) 678-2120  
E-MAIL: MARROYO@ABELLO.DIC.UCHILE.CL

MS

## Status Report

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- Lic. Juan Velozo, presently working toward his Master's degree at the Faculty of Sciences under Professor Dr. Luis Corcuera. He is undertaking a training stage at Dr. Timmermann's laboratory to pursue studies and research related to stress resistance of plants growing in arid lands of Chile.
- Lic. Lohengrin Cavieres, a Ph.D. student under professor Dr. Mary Kalin, will work for two months with Dr. Larry Venable at UA where he will work on ecological models of arid plant evolution.
- Lic. Barbara Saavedra, Department of Biology, will work with the UA's Dr. Julio Betancourt and UCH's Javier Simonetti. Arrangements are being made for her undertaking this stage by mid June 1997.

### Develop long-term research topics in arid lands studies

The very severe drought that affects the IV Region in Chile, and the rest of the country, has forced some limitations to research in this aspect. However, the research sub-project, analysis of agriculture production systems and utilization of natural resources in the Limarí River watershed, has continued progressing toward its target completion date, expected to be finalized during the first quarter of 1997. Funding of this project has been limited since resources for the ALP were reduced due to UCH financial problems. Consequently,

"Economic and Environmental Impact of Mining Activities in Arid Land Agriculture" and "Resolution of Environmental Conflicts in Arid Lands" are moving ahead at a somewhat slow pace. It is expected that 1997 will bring in a new impetus for solving these financial constraints.

### Establish an international arid lands network

Information modules continue to be developed on arid lands-related topics for the Web site. Interested persons can access the information using the following URL: <http://ag.arizona.edu/OALS/oals/projects.html>. One of the items available for selection is the Chile Linkages project. Besides general information about the project, it includes some hypertext links to information on sustainable agriculture, arid lands topics, and other related resources on the Internet.

The FAO Newsletter on Arid Lands Networking is being considered for inclusion in the UDLP Project site of the Web since it complements well with this newsletter.

At the request of Manuel Arroyo, a list of arid lands-related journals, complete with address and contact information, was prepared for UCH's Arid Zone Program.

The proposed workshop on using new technologies for accessing agricultural information was held at the Universidad de Chile (UCH), 2-4 October 1996. This workshop was funded by the International Association of Agricultural Information Specialists (IAALD) and by the USAID through this UDLP project. Arrangements for the workshop were made by the

Sistema de Servicios de Información y Bibliotecas at the UCH. It was attended by 33 information specialists and agronomists from throughout Chile. Barbara Hutchinson, Director of the Arid Lands Information Center, assisted the two workshop facilitators, Sra. Luz Marina and Sr. Mariano Mejia, both from the Centro Internacional de Agricultura Tropical (CIAT), in the preparations and execution of the workshop in Santiago, Chile.

### Establish an updated specialized library at UCH on current arid land sciences

UA has continued supporting the UCH unit with research bulletins and reports which are utilized by researchers and students interested in arid land studies in Chile.

Internet utilization by the UCH side of the project has been increasing. A mailing directory of UCH and related universities on information being received from Infoterra, Agmodels, Econ-ecology is under preparation.

The search for new technical documents related to degradation of natural resources in other regions of Chile has continued. It will become very useful for the upcoming international course on sustainability and desertification.

Concomitant activities related to the UA/UCH project during this period are strengthening the relationships among professionals working in arid lands aiming at sustainability of the resource base.

- Financial support for organizing the V International Course in Sustainable Development and Desertification from various sources seems

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## WORKSHOP REPORT

### New Technologies and Strategies for Accessing Agricultural Information: Report on a Workshop Held at the Universidad de Chile October 2-4, 1996

*Barbara Hutchinson, Luz Marina Alvare, Mariano Mejia*

#### I. Introduction

From 2 to 4 October, 1996, a three-day training course on using new technologies for accessing agricultural information was held at the Universidad de Chile. It was attended by 30 Chilean agricultural information specialists and agronomists who came together to gain greater understanding of the changing information environment and to expand their knowledge of CD-ROM databases and the Internet. The course was funded by the International Association of Agricultural Information Specialists (IAALD) and the U.S. Agency for International Development (USAID) through a grant to the University of Arizona and the Universidad de Chile (UCH).

The training course began with introductions and remarks by Sra. Soledad Ferreiro, Directora de Sistema de Servicios de Información y Bibliotecas (SISIB) and the Centro de Información Estratégica para Agronegocios (CIE) at UCH, Professor Manuel Arroyo, Director of the Program de Zonas Áridas at UCH, and Barbara Hutchinson, Director of the Arid Lands Information Center at the University of Arizona, USA. They outlined the year-long process they undertook to obtain the necessary funding for organizing and conducting the training course. Specifically, they described the two sponsoring agency programs: the USAID University Development Linkages Project (UDLP), and the Education and Training Committee of IAALD.

The idea for the workshop grew out of a USAID program to promote and support the collaboration of U.S. colleges and universities with developing country institutions of higher education. In 1993, through the UDLP, the University of Arizona and the Universidad de Chile received a five-year grant to establish a collaborative, interdisciplinary program to strengthen research, education, and the dissemination of information in the field of sustainable arid lands agriculture. One component of this project is to build resource sharing and dissemination capabilities for arid lands

and agricultural information at the Universidad de Chile. Although not included as part of the original proposal, collaborators in Chile and Arizona determined that a training course focusing on the use of electronic information technologies would provide a valuable mechanism for fostering greater interaction between the two universities. Recognizing the networking potential provided by such an opportunity, the collaborators decided to offer the course to agricultural information professionals from throughout Chile. However, there were insufficient funds within the project to cover all projected expenses, thus it was necessary to locate additional support. IAALD was a particularly appropriate choice with its well-defined commitment to facilitating professional development and communication among members of the global agricultural community and to enhancing access to and use of agriculture-related information resources. Because of this, the course organizers contacted IAALD through its Education and Training Committee and soon after received the additional funding needed. This was the first training activity in Latin America to be supported by IAALD.

To conclude their opening remarks, each of the opening presenters also expressed hope that this training course would lead to greater communication and resource sharing among all the participants and throughout Latin America. In particular, Sra. Ferreiro stated the importance of strengthening the capacity of information professionals to incorporate new technologies into their work environments. As a result of this course, she foresaw the possibility of other opportunities for training in the future.

#### II. Course Expectations

The first day's activities began with an introductory exercise presented by the two training course facilitators: Sr. Mariano Mejia, Coordinador de Servicios al Público, Unidad de Información y Documentación; and Sra. Luz Marina Alvare, Coordinadora de Procesos Técnicos, Unidad de Información y Documentación, both from the Centro Internacional

## Workshop Report

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Agricultura Tropical (CIAT). Workshop materials were handed out, including copies of the overheads for each lecture and copies of the new Spanish-language CAB CD-ROM Manual (donated by CAB International). The participants were given time to interview each other to learn more about their professional experiences and interests. Following this initial dialogue, the participants introduced each other formally to the entire group. This was an especially successful method for bringing the group together and for preparing everyone for the following sessions.

Next the facilitators encouraged the participants to express their particular expectations for what they would like to learn during the training course. The following objectives were stated:

- practical applications of new technologies
- increased networking and communication
- how and where to find agricultural information
- related databases
- Internet resources in other subject areas
- agribusiness information
- representative URLs and other resources
- use of thesauri

These expectations were perfectly in line with the activities already planned and substantiated the need for this kind of learning opportunity.

### III. Chile's National Agricultural Information System and the Role of the Centro Información Estratégica (CIE)

Sr. Raul Dastres Abarca, Director Centro de Información Estratégica (CIE) a sub-unit at SISIB, presented an overview of the events leading up to the creation of CIE. The decision was based on a number of national concerns including: a) a general lack of agricultural information dissemination services; b) limited factual data and information for decision-making; c) an inability of users to articulate needs; d) a lack of understanding on supply and demand; and e) a strong need for information, but low demand. In addition, Sr. Dastres suggested factors for making a successful information service for agribusiness, including: a) a high diversity and quantity of national

and international resources, b) appropriate access mechanisms, c) coordinated information management, d) the support of information specialists, and e) a clear understanding of marketing. He also described the existing national agricultural information system in Chile and outlined the services that SISIB is providing to the system through its service to the academic and business communities. An example of this support is the facilitation of training opportunities such as this course. Although Sr. Dastres felt CIE's experience has been successful in the agricultural environment of Chile up to now, he also believes it is necessary to establish more mechanisms to assure that these services complement various information services provided by other agricultural institutions in the country, such as research institutions and universities. In this way, users will have more opportunities to access information, and possibly at lower costs.

## IV. Course Content

### A. Institutional Change at the Centro Internacional de Agricultura Tropical (CIAT)

As an example of the development of a large research system for agriculture, Sr. Mejia began with an overview of the history of CIAT, focusing in particular on the changes effecting products and services for information and documentation. CIAT, as with other organizations, is restructuring due to changes in financial support. Questions from the participants focused on user reactions to a new policy of charging fees for information services. Sr. Mejia responded that general acceptance of the fees has been slow, but the CIAT staff also has worked hard to help people understand the necessity for them if quality services are to be continued.

Sr. Mejia expanded on this by saying, "Today, our users are more specialized and most of them pay gladly for good service."

### B. Using New Technologies for Information Access

The first day's afternoon sessions, conducted by Sra. Alvare, provided both an overview of new technologies for accessing agricultural information and the administrative changes required to take advantage of the new technologies. Highlights included suggestions on how to choose a system in light of such factors as: budget cuts, user demands for better access, user-

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friendly systems; and requests for new products and services. In addition, public access, acquisition, cataloging, circulation, serials control, and administrative systems were described. Desirable characteristics for these systems were flexibility, versatility, user-friendly qualities, report generation options, and authority control.

Sra. Alvarez also discussed the need for standards if technologies are going to be used effectively for sharing resources and for facilitating communication in the new library environment. The impact of using standards can be seen in increased processing efficiency, faster information exchange, the ability to reach a wider audience, and lower overall costs for knowledge transfer.

Participants, in general, were concerned about the cost of moving to these new technologies. Sra. Alvarez used practical examples of how airmail service, fax, and Ariel (Internet) have been used successfully for document delivery, concluding that, "It has been demonstrated that the rational use of new technologies results in lower costs for both the user and the providers, as well as faster and more efficient service."

### C. The Internet

The second day of the course focused on the Internet and practical hands-on training in its use. Presentations looked at the unique features of this revolutionary communications technology and suggested its potential to act as a global library for use by people throughout the world. Specifically, the evolution of information technology was traced leading to current client-server systems. Web search engines were identified and tried out in the hands-on sessions. Twenty computers with live Internet connections provided the means for participants to try their hand at searching the Web.

Practice exercises guided this process. The participants particularly appreciated receiving a diskette containing CIAT's extensive Web site bookmarks list of selected institutions and tools for agricultural information.

### D. Information Sources for Agribusiness

The second day also included an overview of electronic resources for agribusiness information.

Beginning with an introduction to types of general business information such as industry surveys and specific public and private company directories, this presentation covered product lines from print and CD-ROM to online and Web resources. In particular, databases and Web sites were featured that provide statistical data, marketing and new product information, international trade requirements, and bibliographic information. Lists of relevant Home Pages were included in the handout for this session.

### E. Use of Thesauri

The final day of the course provided a discussion and hands-on training in the use of boolean search strategies and the use of thesauri to modify and enhance electronic searches for topical and targeted information. In general, participants were not familiar with the practical use of thesauri prior to the course. Through practical exercises using the CAB Thesaurus and AGROVOC, participants developed their skills to analyze technical documents.

### V. Course Evaluations

A comprehensive evaluation questionnaire was given to all participants at the end of the training course. Ten specific questions were asked as well as a final overall impression. Five categories offered options for no comment, deficient, average, good, and excellent for each question. In all responses the participants overwhelmingly selected the excellent and good categories. Selected results are included at the end of the report. (A complete evaluation report is available from the authors)

### VI. Conclusion

As can be seen by the course participant's very positive comments, this training opportunity provided a useful and practical introduction to electronic technologies for accessing agricultural information. From this experience, course participants gained increased knowledge about and understanding of the impact of telecommunications technologies on the information organization, and the potential application of these technologies to their own work situation. Through the frank and helpful comments, course facilitators learned to schedule more time for the practice of these new techniques. However, the final lesson of this workshop is that there should be more of these types

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of opportunities, both in terms of professional development and in terms of building human networks through the use of new technologies.

NOTE: The authors wish to thank Sra. Soledad Ferreiro and Sra. Norma Leon, of the Sistema de Servicios de Informacion y Bibliotecas (SISIB) at the Universidad de Chile, for managing the local arrangements for this training course. It was due to their excellent and untiring efforts that the course was brought to a successful conclusion. In addition, we wish to thank Ms. Marie Josee Jehl, Chair of IAALD's Education and Training Committee, and Dr. Barbara Timmermann, Principal Investigator of the University of Arizona's UDLP project, for their help in gaining the necessary financial support.

### Course Evaluation Questions and Answers

1. Evaluate the objectives of the event in terms of your institutional and personal needs; and according to the outcome of the event.

The combined rating of the objectives was excellent (25) and good (5).

Comments included: "it fulfilled all my expectations"; "a new, expanding horizon opened up before me".

2. Evaluate the course's content according to whether it filled gaps in your knowledge about the following subjects: (2.1 - National review of agricultural information; CIAT's experience, general vision of agricultural information; administration of agricultural information; 2.2 - suggested search strategies and use of thesauri; 2.3 - use of Internet).

Ratings in these areas also followed a similar split between excellent and good, with the excellent category selected 3 times more than the good category. Comments included: "brief, concise, and precise"; "I had gaps of knowledge on these topics which are now completely filled".

3. Evaluate the methodological strategies used for instructor's presentations, work groups, quantity and quality of educational materials, evaluation systems, practices, and teaching aids.

Although the instructors were rated as excellent by all of the participants, there were a number of

comments about needing more time for practice. This was a common theme mentioned by many of the participants.

4. Evaluate the applicability (or usefulness) of what you learned for your current and future work.

In this category, participants gave 23 excellent ratings and 7 Good ratings. Comments were variations on this theme, "I have access to Internet but had not been able to use it, until now."

5. Evaluate the local coordination of the event, including information to participants, schedules kept, agenda completed, coordination of groups, coordination of activities, and logistic support.

The average split for this category was 27 with an excellent rating and 3 with a good rating.

6. Evaluate the workshop in terms of its proposed objectives and content.

In this category, a good rating was given by 17 participants and an excellent by 11 participants, with several no comments. Suggestions for improvement focused on offering more days for the workshop so that additional practice time would be possible.

7. Evaluate other activities and/or nonacademic situations that positively or negatively influenced your level of satisfaction with the workshop (food, site of workshop, logistic conditions, and transport).

While a significant majority of the participants gave a rating of excellent in this category, there were comments that a larger conference room with a microphone would have been an improvement.

8. List workshop's strong points.

Comments:

- excellent presentation of topics; good level of information provided
- gaps in knowledge were filled
- the professionalism of the organizers and speakers...
- the relevance of the topics dealt with...
- speaker's knowledge of the topics...
- we received valuable tools that will allow us to plan and establish new services.

9. List workshop's main weaknesses.

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Comments:

- the little time in which to practice
- acoustic problems
- perhaps more time to explore certain topics

10. Provide specific suggestions to improve this type of event both academic and non-academic.

Academic Comments:

- more time and equipment for practices

- explore each subject more
- divide the group between those who have experience and those who do not

Non-academic Comments:

- more information about these events at university level or contacts
- acoustic problems
- coffee break needed during last afternoon

11. How would you qualify this workshop overall.

An excellent rating was given by 27 participants and a good rating was given by 3 participants.

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now a possibility. To this effect, a new schedule has been worked out. In principle, this course will take place in Santiago under the auspices of the University of Chile, FAO, CONAF, IDB, and UNEP, in August 1997. A detailed program is being prepared, and it is expected that it will link well with the UDLP UA-UCH project, as originally conceived.

- A private university, Universidad Educare, invited UCH's ALP to make a presentation on desertification in Chile to update students and faculty on the relevance of the phenomena. The task was organized and delivered by Professor Manuel Arroyo. Desertification has become particularly important in a year when drought is an issue that affects not only arid regions but also, and very strikingly, the capital city of

Santiago. Water shortage has made it necessary to establish rationing, the rivers from the IV to the VII regions have been, or are about to be, intervened for regulating water distribution.

In addition, other universities have shown an interest in being included in this ALP outreach program to disseminate information on desertification research results.

### Other UDLP News

Dr. Donald Nelson travelled to Chile in October to present two seminars, one to the Chilean Society of Biology and the other at the University of Chile at Santiago. He also discussed the potential for a biotechnology program, toured facilities presently available for biotechnology, and worked to identify faculty or academics interested in studying at the University of Arizona. He was also able to travel extensively in Chile to observe methods of sustainable agriculture being used by Chilean farmers and agronomists.

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# INFORMATION RESOURCES

## Books and Articles

Buchmann, Stephen L. and Gary Paul Nabhan. 1996. *The forgotten pollinators*. Covelo, Calif.: Island Press.

Hill, Robert, Phil O'Keefe, and Colin Snape. 1995. *The future of energy use*. Covelo, Calif.: Island Press.

Hurni, H. 1996. *Precious earth: From soil and water conservation to sustainable land management*. Berne: University of Berne, Institute of Geography, Centre for Development and Environment.

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Soule, Judith D. and Jon Piper. 1992. *Farming in nature's image: An ecological approach to agriculture*. Covelo, Calif.: Island Press.

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Van der Ryn, Sim and Stuart Cowan. 1996. *Ecological design*. Covelo, Calif.: Island Press.

Wann, David. 1996. *Deep design: Pathways to a livable future*. Covelo, Calif.: Island Press.

World Resources Institute (WRI). Forthcoming. *Sustainable enterprise in Latin America: A case book*. New York: WRI.

## OTHER NEWS

### Other News

#### Conferences

14–16 May 1997. "Congreso Internacional de Agricultura para Zonas Áridas," Arica, Chile. El Comité Organizador del Congreso Internacional de Agricultura en Zonas Áridas presenta el programa preliminar de este importante evento. Al mismo tiempo se compaña en invitarle a participar en el Programa Científico que considera la presentación de ponencias, paneles, y la realización de seminarios y visitas técnicas. Asimismo, el programa contempla

la posibilidad de conocer ecosistemas tales como el Parque Nacional Lauca, en el Altiplano de la 1 Región, declarado por la UNESCO como patrimonio de la Humanidad y la Pampa del Tamarugal en el Desierto de Atacama.

El Congreso analizará el estado de la investigación científico-tecnológica en zonas áridas. Los nuevos conocimientos, enfoques, y proposiciones permitirán fortalecer las proyecciones del actual avance tecnológico, factor clave para el desarrollo de las naciones y el bienestar de su población en el

próximo siglo.

Contact: Universidad de Tarapaca, Instituto de Agronomía, Avenida General Velásquez 1775, Casilla 6-D, Arica, Chile. Phone/Fax: +56 (58) 226737.

12–16 May 1997. *Combating Desertification: Connecting Science with Community Action*. Tucson, Arizona, USA. Sponsored by United States Department of the Interior Bureau of Land Management, and the International Arid Lands Consortium. Contact: Beaumont C. McClure, Bureau of Land

## Other News

Continued from previous page

Lands Consortium. Contact: Beaumont C. McClure, Bureau of Land Management, Arizona State Office, P.O. Box 16563, Phoenix, AZ 85011-6563. Phone: +1 (602) 650-0206. Fax: +1 (602) 650-0398. E-mail: [bmccclure@attmail.com](mailto:bmccclure@attmail.com).

30 September–2 October 1996.

*The Hemispheric Congress on Disaster Reduction and Sustainable Development*. This brought together a selected group of about 200 key stakeholders from public, private, and international organizations to formulate a series of policy initiatives supporting disaster reduction and sustainable development in the Americas.

<http://www.fiu.edu/~hurricane/congress/congress.html>

## Brazilian Biodiversity Working Group Established

The Brazilian Science Council (CNPq) has established a Brazilian Biodiversity Working Group (GTB) (Grupo de Trabalho em Biodiversidade) with a view to establishing an inter-institutional, technical forum for the various levels of biodiversity (genes, species, communities and ecosystems), which will periodically and systematically meet to examine and discuss questions concerned specifically with the conservation and sustained use of Brazil's fauna and flora. The Working Group will act as a point of reference in supplying advice to government agencies, as well as bilateral and multilateral funding institutions, and the environment and conservation community in general, regarding the

technical and scientific aspects required for the identification of priorities and strategies at the regional and national level. The GTB will also serve as a reference point for the Brazilian members of the Specialist Groups of the World Conservation Union (IUCN) Species Survival Commission (SSC), making use of the scientific and intellectual resources of the largest international voluntary network of experts in biodiversity conservation, today counting on more than 7,000 participants world-wide. Contact Gustavo A. B. da Fonseca, Coordenador do GTB, c/o Conservation International do Brasil, Avenida Antonio Abrahao Caram 820/302, 31275-000 Belo Horizonte, Minas Gerais, Brazil; Tel./Fax: +55 (31) 441-1795; E-mail: [g.fonseca@conservation.org.br](mailto:g.fonseca@conservation.org.br).

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# Tierras Aridas



## CONEXIONES

DEVELOPMENT OF SUSTAINABLE AGRICULTURE IN ARID REGIONS OF CHILE

VOLUME 3, NUMBER 2

**Tierras Aridas** is interested in your ideas for resources or information that would be of interest to other project participants. If you would like to make contributions, send them to the editor:

Michael Haseltine  
Arid Lands Information Center  
The University of Arizona  
1955 E. 6th Street  
Tucson, Arizona 85719-5224  
Telephone: (520) 621-8576  
FAX: (520) 621-3816  
haseltin@ag.arizona.edu

**Tierras Aridas**  
Michael Haseltine, Editor  
Arid Lands Information Center  
1955 E. 6th Street  
Tucson, Arizona 85719-5224

**FIRST CLASS MAIL**

59

**TRAINING COMPONENT**

**Mr. Alejandro Leon  
Graduate Student, Arid Lands Resource Sciences  
Ph.D. Program, The University of Arizona**

**Fall Semester 1996  
Spring Semester 1997  
Summer Semester 1997  
Fall Semester 1997**

Tucson, October 14, 1997

Dr. Barbara Timmermann  
College of Pharmacy  
University of Arizona

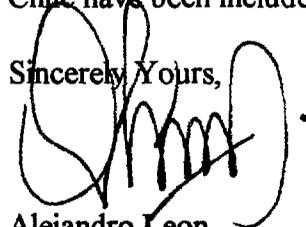
Dear Dr. Timmermann:

Please find enclosed the report that summarizes my academic activities starting spring semester 1996. I have included the courses' title, number of units, grades obtained, points, and my cumulative GPA. The courses of the current semester, fall 1997, and the coming spring 98 are also included.

My Qualifying Committee, whose members are Drs. Charles Hutchinson (Arid Lands), Roger Fox (Agricultural and Natural Resources Economics), and Andrew Comrie (Geography), has recently approved my study plan. This plan considers Arid Lands Resources Sciences -- Development Track -- as Major and Remote Sensing as Minor. I shall complete the 33 units the Common Core and Development Track require, 12 by the Minor program, and 21 units of other courses.

According to the plan, my course work should be completed by the end of next spring semester (2.5 years total time). This means I will be in conditions to take the Preliminary Exams during summer 98. Planning ahead, I have designed my dissertation project, that I have also enclosed. Please notice that a time table and a budget for the field work phase in Chile have been included.

Sincerely Yours,



Alejandro Leon



**TIME TABLE AND  
BUDGET FOR FIELD WORK**

Time Table		98										99									
		May	Jun	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	April	May	Jun	July	Aug	Sept	Oct	Nov	Dec
Course work ends		*																			
Preliminary exam	(written/orals)		*	*																	
<b>Field work (Chile)</b>																					
	Archival research						*	*	*												
	Policymakers interviews				*	*	*	*	*												
	Gather climatic data				*			*													
	Test households survey				*																
	Households survey				*	*															
	Ground truthing				*	*															
	Remote Sensed Imagery Analysis (AZ)	*	*	*						*	*	*									
	Data Processing (Chile and AZ)				*	*	*	*	*	*	*	*	*	*	*	*					
	Bibliographic Review									*	*	*	*	*	*	*					
	Write Dissertation															*	*	*	*	*	*
	Defense																				*
<b>Budget for the Field Work Phase (Chile)</b>																					
Air Travel		US\$																			
	Tucson-Santiago RT	1,500																			
	Santiago - La Serena RT	150																			
Hotel (La Serena)	20 days @\$60	1,200																			
Meals (La Serena)	20 days @\$30	600																			
Car Rental (La Serena)		1,000																			
Gas (La Serena)		300																			
Unforeseen Expenses		1,000																			
<b>Total</b>		<b>5,750</b>																			
Please see notes to the budget on following page.																					

## **Notes to the Time Table and Budget**

1. Field work at the Coquimbo Region should commence as early as possible in August 1998. This is the beginning of the spring season and eventually rains should have ended by then. The ecosystem should be at its maximum greenness. Necessary for ground truthing.
2. Policymakers will have to be interviewed at the study site (Coquimbo Region) and Santiago, the capital city, where the central government is located.
3. The budget includes the expenses necessary for the field work during 5 months. The field work phase includes interviewing policy makers and public officials at the study site as in Santiago, archival research to determine significant policy changes, gathering climatic data, applying the anthropological survey at the study site, data analysis and feedback, and groundtruthing (if possible) of the remote sensed imagery.
4. A period of 20 days at the study site will be necessary to apply the survey and interview local policymakers. Eventually, a second visit to the area may be necessary after processing the obtained data. This explains the 'unforeseen expenses.'
5. Since the period for the field work contemplates a maximum stay of 5 months in Chile (it could be less), the regular expenses at Tucson will not be extinguished (monthly rent, bills, etc.). After returning from Chile, I project a year to completely finish my Ph. D. program. For this reason, I will need the continued aid of the scholarship I currently receive.
6. After returning to Tucson, 18 credits have to be registered for dissertation work.

Alejandro Leon  
Dissertation Proposal  
(DRAFT)

**Public Policy and Vulnerability Of Grazing Systems and Households to  
Climate Variability in the Semi-Arid Region of Chile**

**September 1997**

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## 1. ABSTRACT

Vulnerability and climate variability are two phenomena that co-exist within the semi-arid lands. Grazing systems -- one of the few economic activities in these environments -- are dependent on rainfall that determines both the level of primary production of biomass and the availability of water to sustain animals. Because the rainfall regime is highly variable, so, too, is the availability of biomass and drinking water resources in time and space. Households that rely on grazing systems in semi-arid environments for their livelihood must cope with variations in climate and their own vulnerability as conditioned by ecosystem productivity. Household vulnerability may also be affected by external factors, particularly resource tenure arrangements and public policy that affects access to resources, which may also be reflected in ecosystem condition.

I focus on (1) climate-related vulnerabilities because climatic events on the semi-arid lands, particularly droughts, trigger frequent subsistence crises such as increasing livestock losses, crop failures, dislocation, hunger and famine, and (2) policy-related issues because these -- common and private property regimes, public land grazing, various taxes and subsidies -- have had a differential contribution to the shaping of the current state of the semi-arid ecosystems. The proposed study site is Coquimbo, in northern Chile,

Research will be channeled into four streams of activity:

1. Characterization of regional temperature and precipitation variability so as to establish antecedent conditions using a 30 year period of record.
2. Identification of classes of ecosystem conditions within the study areas using historic and current NOAA/AVHRR NDVI, combined with field observation, spatially related to land tenure.
3. Characterization of the variability of household economies through a survey for a total of about 50 "ranching" households stratified by land tenure type and

size/technology, including household perceptions of those factors that contribute to vulnerability.

4. Evaluation of the economic effects of rangeland overgrazing.

The expected results of this study are (1) to understand the effects of economic and regulatory policies (e.g., access to credit; price subsidies; stocking rates; water allocations) that might be adjusted over the short term, informing the government on preemptive measures to minimize the predicted impacts of climatic variations, (2) to understand the effects of long-term policies related to land resource access on household vulnerability, valuable in aiding local, regional, and national governments to minimize or mitigate negative impacts, and (3) to improve the understanding of the economic effect of overgrazing rangelands.

## **2. INTRODUCTION**

Large areas of several countries of the Americas are dependent on grazing systems both commercially and for subsistence. Rural economies from Northern Chile, especially those which have access only to common land, depend mainly on grazing. Rainfed agriculture is highly dependent on stochastic rainy events, and therefore, not always successful. The grazing systems are highly complex, involving primary and secondary ecological production (i.e. production of basic grasses, to production of cattle), and considerable human intervention.

While temperature, radiation and nutrient input to semi-arid ecosystems vary fairly continuously over the year, precipitation usually comes in discontinuous packages. In semi-arid regions there are only 10 to 50 rainy days a year, occurring in three to fifteen rain events or clusters of rainy days, of which probably no more than 5 or 6 (sometimes only one) are sufficiently large to influence biotic parts of the system.

Thus the input driving the system comes in "pulses" of very short duration relative to the periods of zero input between them. An effective rain event activates biological processes (in particular production and reproduction), and biomass of plant and animal buildup. These processes exhaust the ration of available water supplied by the rain. After a usually short growth period, water resources become the limiting factor and both processes and biomass decrease again to a steady state (which may or may not be equal to the previous one). The master input to arid systems is not only discontinuous but also stochastic (Noy-Meir, 1973).

This condition does not favor crop production without irrigation. Rural economies thus tend to concentrate on the exploitation of natural resources and usually include grazing of animals on limited but spatially extensive resources of forage and browse. Grazing systems are dependant on the rainfall that determines both the level of primary production of biomass and the availability of water to sustain animals and crops. Because the rainfall regime is highly variable, so too is the availability of biomass in time and space.

The semi-arid ecosystems include a number of economically important species and ecotypes, and sustain millions of people. They also support a high proportion of the world's livestock and provide forage for both domestic and wildlife populations (Briske and Heitschmidt, 1991). The management systems, however, range from nomadic pastoralism or subsistence farming to commercial ranching. Usually, overgrazing (the result of animal consumption exceeding carrying capacity) has been a common feature of semi-arid environments throughout the world (WRI, 1992).

The degradation of arid and semi-arid lands has been recognized and documented for many years. The symptoms of land degradation vary from region to region, but are generally considered to include loss of productive, native vegetation and erosion of soil. It is generally agreed that successful understanding and management of the process must be based upon accurate monitoring of the current changes (Warren and Hutchinson, 1984).

Poor people very often live within these areas, that are typically the least productive, most hazardous, and/or most ecologically fragile areas. Moreover, goods such as shelter are inadequate and reliable transportation inaccessible (Chen, 1992). This is often the case in the semi-arid zones of Chile. In these areas, whenever a negative event like a drought (however defined) lengthens, households begin to see their food security at risk. In response, affected people adopt different coping strategies in order to handle the potential decline in their quality of life. These strategies include migration in search of employment, migration with herds to distant pastures, the sale of livestock, and selling or mortgaging of land (Longhurst, 1992).

Although food insecurity and vulnerability are the outcome of interactions between environmental and socio-economic factors in the long and short run, there is a differential vulnerability, whereby diverse peoples suffer differentially in response to the same physical phenomenon in the same area (Winchester, 1992). Individuals, groups, and regions that are most exposed to perturbations, like ENSO, possess the most limited coping capability, and suffer the most crisis impacts (Watts and Bohle, 1993).

Bohle, Watts and Downing (1994) consider policy failure as one of the most important causes of vulnerability. Population growth, resource poverty and household poverty also contribute to increase poor people's vulnerability. In many countries, inadequate economic and agricultural policies have caused or intensified desertification (loss of primary and secondary productivity due to natural or anthropogenic causes) processes. And, as the National Science and Technology Council stresses, policymakers need to know what the consequences of change will be for their regions, and to understand the environmental and socio-economic significance of these consequences (U.S. Global Research Program, 1997).

In Chile, the semi-arid region is located south of the southern fringe of the Atacama Desert. In this area, communal property encompassing about 1 million hectares has existed since the colonial period. These lands have been highly degraded due to

overgrazing by goats, which is the major economic activity in the region. Studies done in the early 70s describe the effect of overgrazing and the lack of rangeland management plans, despite the efforts of the government (Bahre, 1979). This seems to be the case even nowadays. Periodically, livestock and crops are almost entirely lost. Households in this area are considered the poorest in the country. Climate records from the area show a dramatic decrease in precipitation over the last century (University of Chile, 1994) and there is enough evidence showing a steady decrease in crop yields.

Other places in the Americas face land degradation processes too, where policymaking is a factor that has greatly contributed to shaping the current state of the semi-arid zones. For example, sites on either side of the U.S.- Mexico border offer profound differences in land surface conditions, as a result of different land management practices in otherwise comparable environments. The border between the United States and Mexico in the Sonoran Desert has been marked by a fence since 1915. The U.S. side has been protected from overgrazing on private lands since the Taylor Grazing Act of 1934 and increasingly strict management policies have also done much to protect public lands. On the Mexican side, in addition to large and small holdings of private land, there are also two forms of communal land holding. The *comunidad* is a traditional type of group or "corporate" land holding that existed prior to the colonial period. The *ejido* type of communal land holding accompanied the reforms that followed the revolution of 1910 and the splintering of large holdings. *Comunidades* and *ejidos* may result in overgrazing increasing vulnerability to ENSO. Marked differences in land surface parameters on either side of the border have evolved in response to differing land management practices (Beck *et al.*, 1990; Bryant *et al.*, 1990).

Northeast Brazil is another region where poverty and land tenure systems can increase vulnerability and lead to famine and migration. The drought of 1877-79 caused a famine in which about 500,000 people died, while many others migrated from the region. More recently, a period of drought that ended in 1983 negatively impacted the lives of 18 million people. Of all the states in northeastern Brazil, Ceará is the one with the greatest

amount of territory (92%) located within the semi-arid zone, therefore making it the most vulnerable to climatic variability. Preliminary studies have shown that close to 10 percent of Ceará's total area is classified as susceptible to desertification (Leite *et al.*, 1993). Several reports show the extreme vulnerability of social systems in the region to recurring droughts (Glantz *et al.*, 1987; Magalhaes *et al.*, 1988; Magalhaes and Neto, 1991; Magalhaes, 1991). In 1983, a year of strong El Niño, yields of cotton, rice, beans and corn were 50% below normal.

Northern Chile offers an interesting case study, not only because of the dryness of the area, but also because it encompasses two opposite types of agriculture: the communal lands, mostly devoted to grazing and rainfed agriculture, where there is almost no irrigation, and the private holdings, mainly oriented to the production of fresh fruits and vegetables for international markets. The latter usually require high amounts of capital for irrigation technology, cold storage, and transportation.

The region of Coquimbo is part of a contrasting area of Chile because of the socio-economic differences between these two types of property regimes. Many plans have been developed to aid the *comuneros* earn a better living and protect the environment at the same time, with no apparent results up to now.

In this study, I will compare the communal and the privately owned semi-arid lands in the so-called region of Coquimbo, in northern Chile. It is in this region that the processes of under-development undermine the coping abilities and resilience of entire communities.

### **3. OBJECTIVES**

The main objectives of this project are:

- to identify the socio-political and related ecological forces affecting the vulnerability of semi-arid grazing ecosystems of northern Chile, and

- to analyze how physical and policy-related issues affect household vulnerability in this region,
- to increase the understanding of the economic consequences of overgrazing, and
- to assist in the formation/modification of policies mitigating vulnerability to climate variability.

#### **4. RELEVANCE**

While the physical impacts of climate change in the Americas are now being explored, such as in several initiatives of the Intergovernmental Panel on Climate Change (IPCC), the International Research Institute for Climate Prediction (IRICP), the Inter-American Institute for Global Change Research (IAI) projects, the development of desertification indicators in Northeast Brazil by FUNCEME (Kazmierczak, 1996), and several physical studies that are the base of the “National Plan to Combat Desertification” in Chile (Universidad de Chile, 1996), there is a limited understanding of how complex social systems interact and respond to short-term and long-term climatic change. And the vulnerability of grazing systems to climatic variability is even less understood.

In most of these areas grazing is one of the few viable economic activities. The IPCC (1996) report indicates that the adaptability of grazing systems to climatic change will be mainly dependent on the integrity of the ecosystem, which in turn is closely related to the policies and cultural practices governing resource use.

#### **5. PROBLEM**

Grazing is of vital importance to many communities throughout semi-arid ecosystems. In northern Chile rural economies having access to common lands are highly dependent on grazing. These households are also highly vulnerable to market and political changes with dramatic implications for local economies. For example, rural dwellers who inhabit the study area of Coquimbo and graze in common lands, face huge variations in carrying

capacity, due to climatic fluctuations. Hence, they may lose their animals, move them to other areas, or sell them at low prices, all of which have a negative impact on the household economy (Universidad de Chile, 1994). Moreover, competition for water between livestock and agriculture also contributes to increase social conflict in drought ravaged regions.

While grazing systems all over the world are vulnerable to environmental change, those grazing communities located in the tropics are particularly vulnerable to the climatic variability induced by ENSO. When these climatic factors combine with socio-political forces, the vulnerability of grazing societies can dramatically increase. The importance of understanding and mitigating vulnerability has been underscored by the IPCC (1996). Downing (1991), Bohle *et al.* (1994), and Watts *et al.* (1993) have provided detailed analyses of differential household vulnerability to drought in Kenya and Nigeria, while Liverman (1990) describes how the impacts of drought and climate variability vary by region, technology, land tenure, crop, and socioeconomic sector in Mexico.

## **6. NEED**

Little work to date has been devoted to understanding these systems and how they interact and respond to inter-annual climatic and environmental change. Much less work has been done on understanding the role of policy in enhancing or mitigating vulnerability to this change. The IPCC report stressed that research on rangeland ecosystems is needed to better understand how the social systems which depend on these resources will respond to change.

## **7. APPROACH**

### **7.1 Overview of the Project**

The region of Coquimbo has been selected for this study which has semi-arid areas within its territory, where grazing is a major activity on communal lands. This region faces

physical constraints due to climatic conditions. But vulnerability of households in this ecosystem varies: those grazing on communal lands have different constraints as those owning private lands.

The groups living in the semi-arid environment of Chile are vulnerable to external factors. Since some of these are groups with not much resources but with the right of access to common lands, they have overgrazed in order to ensure their subsistence. And because they have no political power, governments have been slow in implementing policies that could directly benefit households and indirectly avoid the depletion of natural resources. Hence, negative climatic impacts (e.g., ENSO) are amplified in these highly vulnerable environments, where susceptible inhabitants live.

Poverty is an important factor to this area. This is why the main focus of this project is on improving our understanding on how physical events and policymaking have mutually contributed to the current condition of semi-arid ecosystems, and which is the economic significance of this process. I also plan to analyze how policy-related issues have affected, positively or negatively, household vulnerability. Ultimately, I intend to assist the local, regional, or national governments in the formation or modification of policies that help mitigate the effects of climate variability over vulnerable households.

## **7.2. Description of the Methodology**

The goal of this study is to estimate the role policy plays in influencing the vulnerability of grazing/ranching dependent households in the study area: Coquimbo, in northern Chile. To accomplish this, it is necessary to characterize the physical and ecological variability of the study areas through time as an indication of “natural variability,” and the correlation between changes in the environment and changes in policy structures. Quantitative and qualitative methodologies will be used to establish time series of climate, vegetation, and policy for the study area. In addition, a quantitative methodology for establishing the economic value of overgrazing communal lands will be used.

### *7.2.1. Climate variability*

To characterize regional climatic variability, a key influence on household vulnerability to climatic impacts, temperature and precipitation data will be collected and analyzed for at least a thirty year consecutive period. This process will identify quasi-cyclical events (e.g., ENSO) as well as other changes (warm/cool periods; wet/dry cycles; more/less variability), and will allow the description of certain trends like desertification.

### *7.2.2. Ecosystem Variability*

Data from the National Oceanic and Atmospheric Administration's (NOAA) Advanced Very High Resolution Radiometer (AVHRR) are available from 1980 onward at low spatial resolution (7.6 km per pixel). It is necessary to use data from this system rather than data from the more recently developed and higher spatial resolution systems (e.g. Landsat or SPOT) because a consistent record over a long time interval is needed to detect changes of interest. Additionally, the measure traditionally used in remote sensing of vegetation levels and growth cycles, the Normalized Difference Vegetation Index (NDVI), is only available at this lower resolution for large areas over long time intervals.

Beginning in 1978, NOAA has operated a series of polar-orbiting satellites designed to monitor weather conditions. These satellites acquire data for any spot on earth twice daily. One of the sensors on-board these satellites has also been extensively used to monitor surface vegetation cover. By combining the red and near-infrared (NIR) spectral channels in a ratio or difference, the NDVI, the sensitivity to photosynthetic activity is enhanced. Typically, data are calibrated and corrections are made to the AVHRR red and NIR channel data prior to calculation of the NDVI (Che and Price, 1992). The NDVI values are then composited to minimize the effects of cloud cover, atmospheric aerosols, and other disturbances. NASA pre-processes the channel data to correct for these effects prior to computing NDVI from the (corrected) channel data. The resultant NDVI can be interpreted as a measure of vegetation vigor and/or density.

AVHRR NDVI data have been successfully utilized to monitor regional to global vegetation patterns (e.g.: Tucker, 1979; Tucker, 1986; Marsh *et al.*, 1992). AVHRR NDVI data have also been successfully employed to assess vegetation conditions in arid and semi-arid lands (e.g.: Prince, 1991; Hobbs, 1995). This data will be correlated with both climatic variability as well as recent policy changes which may affect land use in the study areas. Linkages between regions will be extremely important to the overall vulnerability of agriculture to environmental variation.

Ground truthing will be done once sites are selected and corresponding satellite imagery analyzed.

### *7.2.3. Policy Variability*

The project will focus on land tenure policies, credit, subsidies, government programs and social policies, incentives for poor regions, tax exemptions, and other policies. A survey of the relevant policy history and implications in the study communities will be conducted through interviews. We will carry out extensive and in-depth interviews with policy and decision makers at various levels of government (regional or national) and of technical experts within the agricultural and drought-related policymaking apparatus. These will include interviews with the regional Governor, regional representatives in the National Congress, public agencies officials, researchers at drought-related centers, and technicians in the field. The interviews will include questions about the role of individuals in the policymaking process, political commitment to drought and agricultural policy implementation, current policies for drought and agricultural policymaking, perception of the effect of policies and climate over household vulnerability. I will also do a thorough archival research on policy making and implementation.

### *7.2.4. Characterization of Variability of Household Economies*

Next, I propose to explore through structured and open-ended questioning, and on-site observations of the grazing environment, the implications of recent policy change and climatic variability on household vulnerability and the households' perception of factors

contributing to their vulnerability and natural resource use for grazing. Approximately 50 ranching households in the study area and other participants in the ranching/grazing sector, will be interviewed.

In order to select the appropriate areas and types of households for the surveys, two classes of parameters will be used: tenure, and farm size/technology. Tenure affects the ability of grazing households to respond to drought conditions. The survey will focus on the two main different types of ownership that are to be found within the area: private, and *comunidades*. Farm size and technology variations within a given region are important indicators of vulnerability to drought and the ability to react to drought conditions.

The basic elements to be included in the household questionnaire are:

- Household characteristics: composition, age, education, relationships, etc.
- Employment: on-ranch, other ranch, off-ranch
- Sources of Income: ranch, non-ranch, remittances, etc.
- Ranch Characteristics: size, tenure, livestock and crop (if any) systems, irrigation (if any), other land uses, etc.
- Access to and use of public services - local, regional, national
- Drought experiences and coping strategies

#### *7.2.5. Evaluating the Economic Impact of Overgrazing*

To be completed

### **7.3. Policy Relevance and Usefulness to Decision/Policy Makers**

The study will inform several different types of public policy that condition the vulnerability of households in these regions of extreme climatic variability. The contributions of this study will be twofold. The first is to understand the effects of economic and regulatory policies (e.g., access to credit; price subsidies; stocking rates; water allocations) that are external to the household enterprise that might be adjusted over

the short term. This will allow governments to adopt preemptive measures to minimize the impacts predicted climatic variations. The second is to understand the effects of long-term policies related to land resource access on household vulnerability. Understanding the role that tenure plays in predicting both ecosystem condition and determining vulnerability to climate variations will contribute to help local, regional, and national governments to adjust and reform their institutional apparatus over time so as to control land resource access to minimize or mitigate negative impacts.

## **8. EXPECTED RESULTS**

The expected results are:

- Characterization of regional temperature and precipitation
- Ascertain existence of temperature and precipitation trends
- Determination of changes in ecosystem conditions
- Ascertain existence of desertification processes
- Illustration of the economic significance of overgrazing
- Characterization of household economies
- Identification of household perceptions of vulnerability
- Description of changes in policies over time
- An enabled counseling of the government through increased understanding of the relationships among policy, rangeland management, ecosystem productivity and vulnerability

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FINANCIAL REPORTS

**FINANCIAL STATUS REPORT**

*(Short Form)*

*(Follow instructions on the back)*

1. Federal Agency and Organizational Element to Which Report is Submitted A.I.D.		2. Federal Grant or Other Identifying Number Assigned By Federal Agency PCE5063A003		OMB Approval No. 0348-0039	Page of 1 1 pages
3. Recipient Organization (Name and complete address, including ZIP code) University of Arizona, Sponsored Projects Services P.O. Box 44390, Tucson, AZ 85733-4390					
4. Employer Identification Number 86 - 6004791		5. Recipient Account Number or Identifying Number 300030 et al.		6. Final Report <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	7. Basis <input checked="" type="checkbox"/> Cash <input type="checkbox"/> Accrual
8. Funding/Grant Period (See instructions) From (Month, Day, Year) 9/18/96		9. Period Covered by this Report To (Month, Day, Year) 9/28/98		From (Month, Day, Year) 4/1/97 To (Month, Day, Year) 9/30/97	
10. Transactions:			I Previously Reported	II This Period	III Cumulative
a. Total outlays			353,746.73	6,127.67	359,874.40
b. Recipient share of outlays			79,329.47	**	79,329.47
c. Federal share of outlays			274,417.26	6,127.67	280,544.93
d. Total Unliquidated Obligations					*
e. Recipient share of unliquidated obligations					*
f. Federal share of unliquidated obligations					*
g. Total Federal Share (Sum of lines c and f)					280,544.93
h. Total federal funds authorized for this funding period					360,000.00
i. Unobligated balance of Federal funds (Line h minus g)					79,455.07
11. Indirect Expense	a. Type of Rate (Place "X" in appropriate box)				
	<input type="checkbox"/> Provisional <input checked="" type="checkbox"/> Predetermined <input type="checkbox"/> Final <input type="checkbox"/> Fixed				
	b. Rate	c. Base	d. Total Amount	e. Federal Share	
12. Remarks: Attach any explanations deemed necessary or information required by Federal sponsoring agency in compliance with governing legislation.					
* Unliquidated obligations are not included in this report.					
** Cost Sharing will be reported at termination.					
13. Certification: I certify to the best of my knowledge and belief that this report is correct and complete and that all outlays and unliquidated obligations are for the purposes set forth in the award documents.					
Typed or Printed Name and Title Paul Sandoval, Sponsored Programs Administrator, SR.				Telephone (Area code, number, and extension) (520) 626-6660	
Signature of Authorized Certifying Official <i>Paul Sandoval</i>				Date Report Submitted 10/8/97	

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## FINANCIAL STATUS REPORT

(Short Form)

(Follow instructions on the back)

1. Federal Agency and Organizational Element to Which Report is Submitted <b>A.I.D.</b>		2. Federal Grant or Other Identifying Number Assigned By Federal Agency <b>PCE5063A00303300</b>		OMB Approval No. <b>0348-0039</b>	Page of <b>1 1</b> pages
3. Recipient Organization (Name and complete address, including ZIP code) <b>University of Arizona, Sponsored Projects Services P.O. Box 44390, Tucson, AZ 85733-4391</b>					
4. Employer Identification Number <b>86 - 6004791</b>		5. Recipient Account Number or Identifying Number		6. Final Report <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	7. Basis <input checked="" type="checkbox"/> Cash <input type="checkbox"/> Accrual
8. Funding/Grant Period (See instructions) From (Month, Day, Year) <b>9/18/93</b>		To (Month, Day, Year) <b>9/28/98</b>		9. Period Covered by this Report From (Month, Day, Year) <b>1/1/98</b> To (Month, Day, Year) <b>3/31/98</b>	
10. Transactions:		I Previously Reported	II This Period	III Cumulative	
a. Total outlays		<b>273,786.90</b>	<b>10,274.20</b>	<b>284,061.10</b>	
b. Recipient share of outlays		<b>79,329.47</b>	<b>**</b>	<b>79,329.47</b>	
c. Federal share of outlays		<b>194,457.43</b>	<b>10,274.20</b>	<b>204,731.63</b>	
d. Total Unliquidated Obligations				<b>*</b>	
e. Recipient share of unliquidated obligations				<b>*</b>	
f. Federal share of unliquidated obligations				<b>*</b>	
g. Total Federal Share (Sum of lines c and f)				<b>204,731.63</b>	
h. Total federal funds authorized for this funding period				<b>360,000.00</b>	
i. Unobligated balance of Federal funds (Line h minus g)				<b>155,268.37</b>	
11. Indirect Expense	a. Type of Rate (Place "X" in appropriate box) <input type="checkbox"/> Provisional <input checked="" type="checkbox"/> Predetermined <input type="checkbox"/> Final <input type="checkbox"/> Fixed				
	b. Rate	c. Base	d. Total Amount	e. Federal Share	
12. Remarks: Attach any explanations deemed necessary or information required by Federal sponsoring agency in compliance with governing legislation.  * Unliquidated obligations are not included on this report. ** Cost Sharing will be reported at termination.					
13. Certification: I certify to the best of my knowledge and belief that this report is correct and complete and that all outlays and unliquidated obligations are for the purposes set forth in the award documents.					
Typed or Printed Name and Title <b>Paul Sandoval, Sponsored Programs Administrator, SR.</b>				Telephone (Area code, number, and extension) <b>(520) 626-6660</b>	
Signature of Authorized Certifying Official <i>Paul Sandoval</i>				Date Report Submitted <b>4-17-97</b>	

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# FINANCIAL STATUS REPORT

(Short Form)

(Follow instructions on the back)

1. Federal Agency and Organizational Element to Which Report is Submitted  A. I. D.	2. Federal Grant or Other Identifying Number Assigned By Federal Agency  PCE5063A00303300	OMB Approval No. 0346-0039	Page 1	of 1	pages
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3. Recipient Organization (Name and complete address, including ZIP code)  
 University of Arizona, Sponsored Projects Services  
 P. O. Box 3308  
 Tucson, AZ 85722-3308

4. Employer Identification Number 86-6004791	5. Recipient Account Number or Identifying Number 300030 et al	6. Final Report <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	7. Basis <input checked="" type="checkbox"/> Cash <input type="checkbox"/> Accrual
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8. Funding/Grant Period (See instructions) From: (Month, Day, Year) 09-18-93	To: (Month, Day, Year) 09-29-98	9. Period Covered by this Report From: (Month, Day, Year) 10-01-96	To: (Month, Day, Year) 12-31-96
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10. Transactions:	I Previously Reported	II This Period	III Cumulative
a. Total outlays	263,706.15	10,080.75	273,786.90
b. Recipient share of outlays	79,329.47	**	79,329.47
c. Federal share of outlays	184,376.68	10,080.75	194,457.43
d. Total unliquidated obligations			*
e. Recipient share of unliquidated obligations			*
f. Federal share of unliquidated obligations			*
g. Total Federal share (Sum of lines c and f)			194,457.43
h. Total Federal funds authorized for this funding period			360,000.00
i. Unobligated balance of Federal funds (Line h minus line g)			165,542.57

11. Indirect Expense	a. Type of Rate (Place "X" in appropriate box) <input type="checkbox"/> Provisional <input type="checkbox"/> Predetermined <input type="checkbox"/> Final <input type="checkbox"/> Fixed			
	b. Rate	c. Base	d. Total Amount	e. Federal Share
	-0-			

12. Remarks: Attach any explanations deemed necessary or information required by Federal sponsoring agency in compliance with governing legislation.

\* Unliquidated obligations are not included on this report  
 \*\* Cost Sharing will be reported at termination

13. Certification: I certify to the best of my knowledge and belief that this report is correct and complete and that all outlays and unliquidated obligations are for the purposes set forth in the award documents.

Typed or Printed Name and Title  Sponsored Programs Administrator	Telephone (Area code, number and extension)  (520) 626-6660
Signature of Authorized Certifying Official <i>Paul Jandora</i>	Date Report Submitted 1-27-97

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