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Report of the CRN-I Program

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The IAI Collaborative Research Network Program (CRN)

The Collaborative Research Network (CRN) program was approved in 1998. It began in 1999, as a five-year program (1999–2003) with an initial investment of about US$10 million for 14 grants (14 CRNs). The groundwork for this unique initiative was laid in 1994, when the IAI invested over $2 million in the support of 37 groups of scientists. The mechanism was a series of scientific programs and science-capacity-building efforts, in partnership with various governmental and non-governmental science organizations located throughout the Americas. The CRN program is the direct outgrowth and, in many ways, the culmination of those earlier programs in the sense that it has been the vehicle by which the IAI has reached most of its main objectives:

- to improve understanding of regional global change phenomena;
- to set up international networks for research into global change issues;
- to produce information for policy- and decision-makers; and
- to expand scientific capacity in the Americas.

The CRN was not designed simply to support research, but to encourage synergistic efforts on the part of scientists working throughout the Americas on global-change problems of importance to the region. Effectively addressing regional global-change issues requires an active scientific network that crosses international boundaries: scientists and scientific institutions working together in an integrated and collaborative fashion. The networks are designed to enable in-depth investigation of a wide range of pressing topics concerning global environmental change; and they are highly multidisciplinary, including natural and social sciences. The information they generate will be significant, high-quality scientific information that can be used by stakeholders and policy- and decision-makers to mitigate and prevent harmful environmental changes and their impact on our societies. The world's foremost global-change experts in the Americas are leading the development of the networks. The number of scientists and/or institutions affiliated with the CRN program increases every year as PIs and Co-PIs find new collaborators. Supplemental and/or parallel funds raised by CRN PIs have also continued to grow. As of June 2004, supplemental/parallel funds exceed US$ 20 million and are distributed across the projects as shown in Table I.

Table I. CRN Supplemental/Parallel Funding, 2003–2004

Project # - PI	***Add. Funds in US$***
CRN 001 – Holm Tiessen	4.277.439
CRN 003 – Brian Luckman	1.969.889
CRN 009 – Charles Wood	2.693.994
CRN 012 – Osvaldo Sala	390.194
CRN 026 – Maria Vernet	1.091.694
CRN 031 – Allan Lavell	361.320
CRN 040 – Juan Silva	301.999
CRN 047 – Michael McClain	2.029.996
CRN 048 –Ulisses Confalonieri	265.208
CRN 055 – Mario Núñez	2.753.387
CRN 061 – Edmo Campos	2.688.197
CRN 062 – Tim Baumgartner	1.172.496
CRN 073 – Victor Magaña	654.200
Total	20.650.013

The major contributors of the funds shown in the table are national organizations from the science and technology sector of IAI member countries. Other institutions providing funds for CRN projects

include the European Union, France, Germany, the United Nations Development Program (UNDP), the Global Environmental Facility (GEF), the World Bank, and the Red Latino Americana de Botánica.

Since the beginning of the CRN program in 1999, 429 students (161 undergraduate, 128 Master's, and 140 doctoral) have benefited from participating in CRN projects.

The growth of both participation and funding for the CRNs shows that the CRN program has been very effective in extending and increasing the number of institutions composing these international research networks. Even countries that are not members of the IAI, such as EU countries, South Africa, and Australia, are now joining CRNs.

Table II. Projects Funded under the CRN Program

#	Title of Project and Funding in US$	Principal Investigator	Participating Countries
001	Biogeochemical Cycles under Land Use Change in the Semiarid Americas **US$ 818,000**	**Tiessen, Holm**	**Canada**, Argentina, Brazil, Mexico, Venezuela
003	The Assessment of Present, Past, and Future Climate Variability in the Americas from Treeline Environments **US$ 820,000**	**Luckman, Brian**	**Canada**, Argentina, Chile, Bolivia, USA, Mexico
009	Cattle Ranching, Land Use and Deforestation in Brazil, Peru, and Ecuador **US$ 658,284**	**Wood, Charles**	**USA**, Brazil, Ecuador, Peru, Canada
012	The Role of Biodiversity and Climate in the Functioning of Ecosystems: A Comparative Study of Grasslands, Savannas, and Forests **US$ 819,826**	**Sala, Osvaldo**	**Argentina**, Chile, Mexico, USA, Uruguay, Venezuela
026	Enhanced Ultraviolet-B Radiation in Natural Ecosystems as an Added Perturbation due to Ozone Depletion **US$ 820,000**	**Vernet, Maria**	**USA**, Argentina, Brazil, Canada, Chile
031	ENSO Disaster Risk Management in Latin America: A Proposal for the Consolidation of a Regional Network for Comparative Research, Information, and Training from a Social Perspective **US$ 808,920**	**Lavell, Allan**	**Peru**, Argentina, Brazil, Colombia, Costa Rica, Ecuador, Mexico, USA
040	Estudio Comparativo de los Efectos de Cambios Globales sobre la Vegetación de Dos Ecosistemas: Alta Montaña y Sabana Tropical **US$ 552,000**	**Silva, Juan**	**Venezuela**, Colombia, Brazil, Argentina
047	Andean Amazon Rivers Analysis and Monitoring (AARAM) Project **US$ 788,830**	**McClain, Michael**	**USA**, Peru, Brazil, Bolivia, Colombia, Ecuador
048	Diagnostics and Prediction of Climate Variability and Human Health Impacts in the Tropical Americas **US$ 799,498**	**Confalonieri, Ulisses**	**Brazil**, USA, Colombia, Mexico, Jamaica, Venezuela
055	Development of a Collaborative Research Network for the Study of Regional Climate Variability and Changes, their Prediction and Impact in the MERCOSUR Area **US$ 819,180**	**Nuñez, Mario**	**Argentina**, Brazil, Paraguay, Uruguay, USA
061	South Atlantic Climate Changes (SACC): An International Consortium for the Study of Global and Climate Changes in the Western South Atlantic **US$ 819,000**	**Campos, Edmo**	**Brazil**, Argentina, Uruguay, USA
062	An Eastern Pacific Consortium for Research on Global Change in Coastal and Oceanic Regions **US$ 820,000**	**Baumgartner, Timothy**	**Mexico**, Canada, USA, Costa Rica, Peru, Chile, Colombia, Ecuador
073	Climate Variability and its Impacts in the Mexican,	**Magaña, Victor**	**Mexico**, USA, Costa Rica,

	Central American, and Caribbean Region **US$ 293,300**		Brazil, Colombia

CRN Completion Dates *(as of 13 April 2005)*

		2003	2004												2005												2006											
	CRN #	**12**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
WOOD	**009**																																					
MAGAÑA	**073**																																					
CAMPOS	**061**																																					
McCLAIN	**047**																																					
VERNET	**026**																																					
LAVELL *(Franco)*	**031**																																					
BAUMGARTNER	**062**																																					
TIESSEN	**001**																																					
LUCKMAN	**003**																																					
SILVA *	**040**																																					
NUÑEZ	**055**																																					
SALA	**012**																																...				...	
CONFALONIERI	**048**																																					
Last Project Report due																																						
Report to NSF																																						

Note: Final Reports are due within 90 days of the completion date

** Request for additional six months pending*

Original Completion Date
Revised Completion Date
Final Technical Report received

CRN 001, Biogeochemical Cycles under Land Use Change in the Semiarid Americas
Holm Tiessen

PI: Holm Tiessen, with participation of the University of Saskatchewan, and partners in Argentina, Brazil, Mexico and Venezuela has been able to generate important data on land and soil degradation and on resource management options to improve land quality.

Our research on organic matter, nutrient cycling and erosion has combined to solve a puzzle on land degradation in northeastern Brazil. In this region of scarce but intense rainfall, evidence of erosion is obvious, but the typical soil quality indicators do not confirm the impact of erosion. The team used measurements of radioactive Cs137 that had labeled the earth's surface evenly during the 1960 hydrogen bomb tests, to calculate top soil loss. Sediment losses since the bomb fallout period 40 years ago were calculated at 220 kg soil m^{-2} from shoulder slopes, equivalent to a 20-cm layer of top soil. Losses from the back slope position were even higher, estimated at 268 kg soil m^{-2}, equivalent to a 24-cm layer. Both levels represent very serious erosion rates. Studies on soil carbon confirmed very rapid soil organic matter turnover in soils of several regions of the Northeast. Turnover rates of less than 50 years were measured, indicating a high potential for degradation and the need for careful management of land cover. The high carbon turnover and high erosion rates combine to make these soils highly susceptible to degradation, but also obscure the degradative processes. Organic matter turnover, both accretion and mineralization, is so fast that carbon levels are hardly affected by erosion. Unlike in temperate regions, organic matter level is therefore a poor indicator of land degradation by erosion.

Also in NE Brazil, work on water and nutrient cycling in on-farm trials has shown the positive impact of agroforestry and of including succulents (forage cactus) into cropping systems. This has stabilized food and fodder production and improved and stabilized income. Further studies on this positive impact of increasing "useful" biodiversity on land management are showing improved water use efficiency and long-term sustainability. An increased use of native legume trees in these studies aims at improved biodiversity conservation.

Isotope studies using C14 dating and natural C13 replacement have shown the much more rapid C turnover in tropical as compared to temperate soils. We applied these techniques to the warm temperate soils of La Pampa province, where soil degradation and long-term sustainability is a concern. Several sites under different management and vegetation cover showed very fast C turnover with half-lives of only 10 to 12 years. This compares to half-lives of 50 to over 100 years in temperate grasslands of North America. This surprising and alarming result confirms the high susceptibility to land degradation of the semiarid regions of La Pampa. This affirms that land conservation management is of great importance, and that lessons from the well-studied Great Plains can not be applied without careful adaptation. One very troubling result was that soils of one region that suffered severe degradation under conventional arable agriculture were unable to recover original organic matter levels under reclamation attempts with pastures. This is a rare but important evidence of a threshold of irreversibility (or at least considerable hysteresis) in the degradation process. The impacts of land quality and its decline on social and economic well-being of the region are now being quantified in detail.

In Yucatan, off-farm income opportunities have caused wide-spread abandonment of traditionally managed shifting cultivation fields. This process started during the period of our CRN activities, and we were able to accompany social and land cover changes, develop a social accounting matrix and implement an ecological land-use planning in cooperation with municipalities. Within this program of research, extension and implementation, a number of detailed studies were conducted on aspects of land cover management, such as limitations for tree establishment, the economic viability and appropriate tree management for fruit and timber production, the negative impact of irrigation on insect infestation, and the potential of trees for

productivity and reclamation of quarries.

Adapting management and land-use decisions to the constraints and opportunities of landscape has become a central concern. Within this, it has become clear that many of the land-use changes are driven by alternative economic opportunities including subsidies and are unrelated to resource quality. A great danger of this process is that land-use decisions (or the lack of conscious decisions) are independent of the needs for resource conservation. In Yucatan, this occurs at a time when the production pressures on the land are easing; creating important opportunities for establishing ecological reserves that incorporate a managed and productive landscape.

H. Tiessen April 4, 2005

CRN 003, The Assessment of Present, Past and Future Climate Variability in the Americas form Treeline Environments

Brian Luckman

The overall summary of our work along the transect has been reported by Ricardo Villalba at` a major tree-ring conference in Tucson in April 2004 and is currently being written up for publication. It demonstrates strong linkages between temperature series in Patagonia and Alaska and inverse but statistically significant relationships with coral records from the Central Pacific. Other significant results have been the first reconstructions of streamflow from Mexico and Chile which have major significance in terms of the future potential of tree ring studies to contribute to studies of hydrologic variability and water supply throughout the Americas.

We held the final meeting of the CRN from March 28-29 at Akumal in Mexico where 20 papers were presented reviewing both individual projects and the general contribution that CRN03 has made to dendrochronology in Argentina, Chile, Mexico and to education. Ten PIs attended with 12 students and junior researchers. This meeting was held in conjunction with a meeting on Climate and History organized by Henry Diaz and David Stahle that looked at many of the impacts of climate and climate variability on Society and particularly within Mexico and Central America. Three of the PIs in CRN03 contributed to both meetings.

The CRN organized and funded the 3rd South American Dendrochronological Fieldweek was held in Pro-Mata, Rio Grande do Sul, Brazil, between 8th-14th January 2005. This meeting was organized in conjunction with the new Laboratory at Rio Grande do Sul recently funded by SGP2 This fieldweek had the greatest range of IAI countries represented, with 12 students from Brazil, 7 Argentineans, and 3 Chileans, 2 students from each of Peru and Bolivia and single representatives from Cuba, Ecuador, Mexico, Puerto Rico and Venezuela. In our first venture into Brazil we had three Brazilian leaders, 2 Argentineans and a Canadian. All told we have supported over 80 students in these endeavours over the last five years.

The final major contribution in 2004-5 was the preparation of papers for a special issue of the journal Dendrochronologia that will be published in the summer of 2005. This volume presents a series of examples and case studies of the applications of dendrochronology to Human dimensions Issues in Global Changes. These can be broadly classified as studies of the past impacts of climate on societies, Ecological studies applied to land use and forest management problems, new developments in tropical dendrochronology and reconstructions of hydroclimatic variability. A listing of the contents follows. Plans are also in development for a major proceedings volume summarizing the work of the CRN over the last five years.

Brian Luckman, Porto Natales, 9th April 2005.

B. H. Luckman. Dendrochronology and Human Dimensions Issues in Global Change

M. D. Therrell. Tree rings and “El Año del Hambre” in Mexico

R. Gil Montero and R. Villalba. Tree rings as a surrogate for economic stress- an example from the Puna of Jujuy, Argentina in the 19th century

D.J.Smith, A. Mackie and I Sumpter. Building Quaksweaqwul: Dendroarchaeological investigations at Kiixin National Historic Site, Vancouver Island, Canada

P. E. Villagra, J. A. Boninsegna, J. A. Alvarez, M. Cony, E. Cesca and R. Villalba. Dendroecology of *Prosopis flexuosa* woodlands in the Monte Desert: Implications for their management

M. Morales, R. Villalba and J. A. Boninsegna. Climate, land-use and *Prosopis ferox* recruitment in the Quebrada de Humahuaca, Jujuy, Argentina

M. E. González. Fire history data as reference information in ecological restoration

R. Campbell, D. J. Smith and A. Arsenault. Dendroentomological and forest management implications in the Interior Douglas-fir zone of British Columbia, Canada

J. Villanueva-Diaz, B.H. Luckman, D.W. Stahle, M.D. Therrell, M.K Cleaveland, J. Cerano-Paredes, G. Gutierrez-Garcia, J. Estrada-Avalos, and R. Jasso-Ibarra. Reconstruction of hydroclimatic variability of the upper Nazas river basin and its implications for the irrigated land area of the Comarca Lagunera, Mexico

A. Lara, R. Urrutia, R. Villalba, B. H, Luckman, D. Soto, J.C. Aravena, McPhee, A. Wolodarsky, L. Pezoa, J. León. The Potential of tree-rings for streamflow and estuary salinity reconstruction in the Valdivian Rainforest Eco-region, Chile.

E. Watson and Brian H. Luckman An exploration of the controls of pre-instrumental streamflow using multiple tree-ring proxies

R. Rodríguez, A. Mabres, B. H. Luckman, M. Evans and M. Masiokas. "El Niño" events recorded in dry-forest species of the lowlands of northwest Peru

F. A. Roig, J. J. Jimenez Osornio, J.Villanueva- Diaz, B. H. Luckman, H. Tiessen, A. Medina, and E. J. Noellemeyer. Anatomy of growth rings of selected trees from the Yucatán Peninsula, México

L. Paolini, R. Villalba and H. R. Grau. Precipitation variability and landslide occurrence in a subtropical mountain ecosystem of NW Argentina

A. Wolodarsky-Franke and A. Lara. The role of "forensic" dendrochronology in the conservation of *Fitzroya cupressoides* (Alerce) forests in Chile.

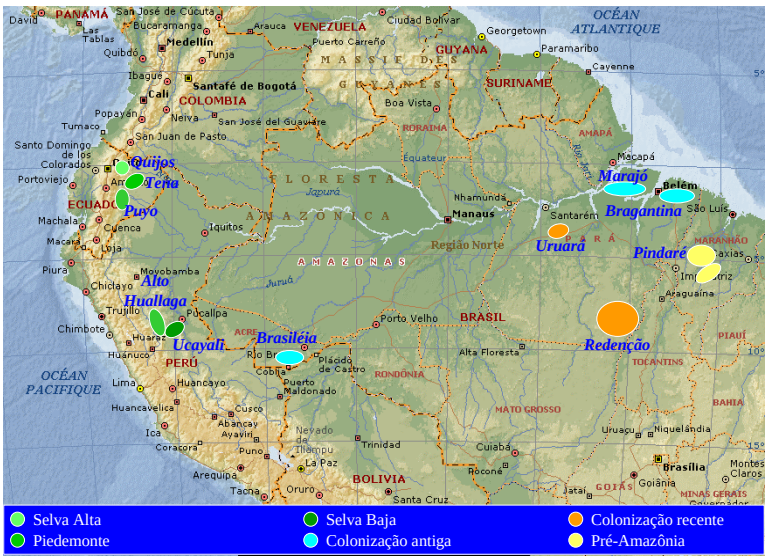
C. P. Laroque and D. J. Smith. Predicted short-term radial-growth changes based on past climate on Vancouver Island, British Columbia

CRN 009, Cattle Ranching, Land Use and Deforestation in Brazil, Ecuador and Peru
Charles Wood

The project, now completed, carried out research in rural Ecuador and Peru, and in three rural sites in the Brazilian Amazon (see Map). In-depth interviews were performed with land managers by interdisciplinary teams of researches drawn from the three countries. Data collection and analysis focused on the decision making process by which rural establishments take into account social and biophysical factors in the decision to invest in cattle, in the choice to establish and manage pasture, and in the strategies to deforest primary or secondary growth.

The findings showed that deforestation is taking place in all regions, although the pace of land use change varies across sites. Similarly, the choice of pasture management strategies depends on the internal characteristics of rural households, on price and market structures, and on the historical and cultural characteristics of the populations involved. While deforestation was an outcome common to nearly all of the research sites, the factors that lead to deforestation varied from one context to another, and by the type of producer involved. An understanding of land use decisions is important because of the environmental consequences of converting forest to pastures. It is widely understood that deforestation is associated with reduced biodiversity, changes in hydrology, increased soil erosion, and alterations in microclimates. Moreover, the burning of biomass releases large quantities of carbon into the atmosphere in the form of carbon dioxide, while cattle themselves are an additional source of methane gas, which is produced in the bovine intestinal tract. An analysis of the expansion of cattle ranching was therefore a way to address a wide range of priority environmental issues. The multi-leveled, interdisciplinary, and comparative approach added to the scholarly understanding of the factors that drive environmentally significant land use decisions. In addition, the approach generated the kind of information required to formulate recommendations to encourage alternative forms of land use and promote sustainable pasture management.

The project generated seven book-length monographs: an edited volume on land use and deforestation in the Amazon; a monograph on each of the five research sites (in Brazil, Ecuador and Peru), and an edited volume that synthesized and compared the results of the regional monographs. Another 6 books, 24 articles, and 12 presentations publication were associated with the CRN project (see Item 5).CRN 009 trained young scholars by incorporating them into the fieldwork and providing modest research awards to carry out independent research on topics relevant to the CRN's objectives. Direct or in kind support from CRN 009 contributed to the completion of 20 academic degrees at various levels (5 completed Ph.Ds; 9 Ph.D. candidates; 4 MS, 2 BS degrees) in a variety of disciplines (Anthropology, Ecology, Economics, Sociology, Geography, Agrarian Science, Agroforestry, Political Science and Agronomy).



CRN 012, The Role of Biodiversity and Climate in the Functioning of Ecosystems: A Comparative Study of Grasslands, Savannas, and Forests

Osvaldo Sala

Human activity is currently causing dramatic changes in the biodiversity of many of the Earth's ecosystems, and it is not clear what will be the consequences of these changes on the ability of these ecosystems to provide goods and services to humanity. However, it is clear that the maintenance and preservation of biodiversity is one of the pressing concerns for the global community in the next century. The prominence of the preservation and maintenance of biodiversity as a world concern affects political agendas, governments, and public policy. For this reason, the research being conducted as part of the project CRN-012, The Role of Biodiversity and Climate in the Functioning of Ecosystems: A Comparative Study of Grasslands, Savannas, and Forests have implications for science, conservation and public policy and management decisions from the local to the global scale.

Project personnel include researchers, graduate students and technicians from six countries. There are a number of ongoing research activities in various ecosystems in North and South America, including temperate forests in Argentina, Chile and México, shrub-steppe ecosystems in Patagonia, Argentina and the central United States, grasslands in the Pampas region of Argentina and Uruguay and the northern Great Plains of North America, and tropical savannas in Venezuela. They are exploring a number of interesting questions related to biodiversity and ecosystem functioning, including the relationship between biodiversity and primary productivity, the effect of plant species diversity on decomposition and carbon turnover, the role of biodiversity in controlling nutrient cycling along climatic gradients, the effect of life-form shifts on nutrient pools, and the importance of microbial diversity in determining ecosystem functioning.

Results from the field experiments in South America have demonstrated promising results and have shed new insight on the relationships between biodiversity and ecosystem functioning. In particular, the focus on ecosystems in temperate South America that have received relatively little human impact has provided new information with respect to the importance of biodiversity in intact ecosystems. Vascular plant removal experiments in the Patagonian steppe have shown that the relationship between biodiversity (species richness) and net primary productivity is positively correlated, as has been shown in a number of experiments with artificially constructed communities. However, in the Patagonian steppe, this relationship is much more pronounced, such that changes in diversity result in more dramatic changes in primary production. This is attributed to the fact that these experiments have been conducted in an intact ecosystem, where long-term consequences of species interactions have developed, and that in particular, the effect of positive species interactions (facilitation) can be observed.

Experimental results from the Southern temperate forest have also demonstrated important insight. Research in a forest mosaic has demonstrated a significant relationship between aboveground vascular plant diversity and belowground soil organisms. The abundance of soil functional groups appears to be affected by the input and quality of organic matter entering the soil pool, via differences in litter quality from different species. In addition to the direct effect on soil organisms, these differences in litter quality affect rates of carbon and nitrogen turnover in these sites, both directly through changes in litter input, and indirectly through long-term effects on carbon and nitrogen pools. These results are novel in that the relationships between above- and belowground diversity have been difficult to establish, in part because it has been extremely difficult to examine these relationships in intact ecosystems, and particularly long-lived ecosystems such as forests. Results from both the Patagonian steppe and the Andean temperate forests demonstrate the importance of using intact ecosystems for exploring these fundamental ecological relationships, and to accurately assess the importance of biodiversity loss for ecosystem functioning.

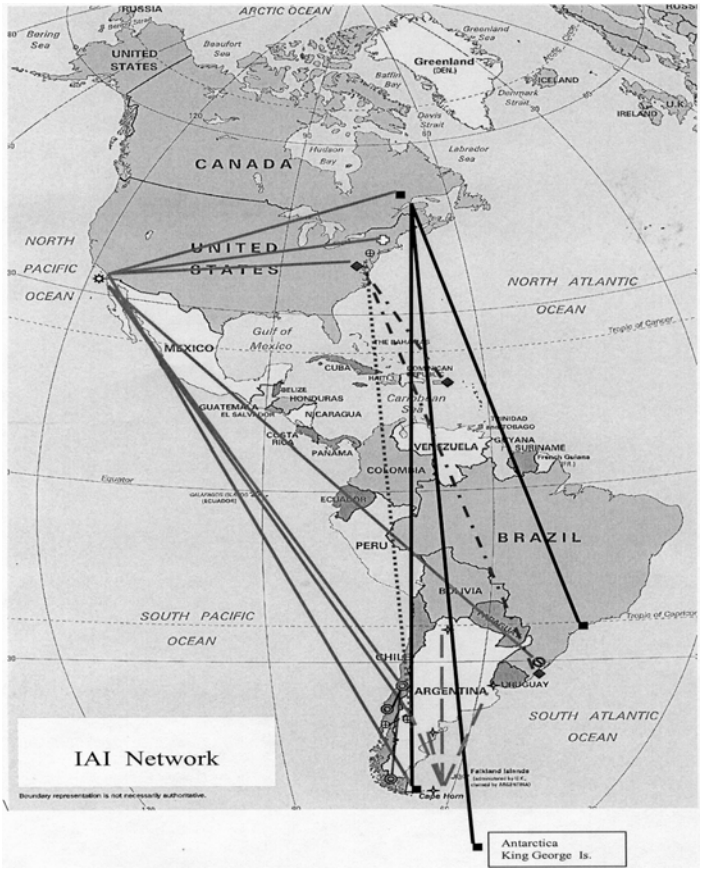
Capacity building has been a central focus of the CRN-012. There are currently seven full-time graduate students working within the framework of the CRN-012, and two students who have completed their doctoral degrees and are now working as post-doctoral fellows on research related to the CRN-012 (Martín Carmona and Ek Del Val). Additionally, the links between the CRN-012 and other international organizations grows every year. In addition to the previous collaborations with the Fundación Antorchas of Argentina, the Red Latinoamericana de Bótanica and Scientific Committee for Problems of the Environment (SCOPE), This year, Osvaldo Sala played a key role as lead author in the biodiversity scenarios section of the Millennium Ecosystem Assessment, which incorporates many of the central ideas of the CRN-012 in a global framework of threats to biodiversity and their impact on ecosystems. To date, the research conducted within the network of CRN-012, has resulted in 2 edited books, 45 scientific articles published or in press, 19 book chapters, and 4 popular articles. The research and capacity building activities highlight the importance of biodiversity as both an interdisciplinary science, as well as an emerging issue of both local and global significance for public policy.

CRN 026, Enhanced ultraviolet-B radiation in natural ecosystems as an added perturbation due to ozone depletion

Maria Vernet

The are 3 main **objectives:** (1) to make scientific advances on a regional scale; (2) to integrate local and national efforts into a cohesive but flexible body; and (3) to make scientific results available to the affected public. We are testing the general **hypothesis** that the response of organisms and systems to UVR varies along gradients. The **approach** includes three levels of activity: data collection, ecosystem modeling and socio-economic studies.

The **network** is composed of 25 principal investigators (PI) from18 institutions in 5 countries. From those, 6 institutions in 4 countries (Argentina: Universidad del Comahue, Universidad del Lujan, Centro Austral de Investigaciones Cientificas; Canada: Université du Quebec; Chile: Universidad de Chile; and US: University of Maryland) act as nodes between 11 additional institutions (Argentina: Universidad de la Patagonia, Instituto de Genetica y Biotecnologia, Instituto Antarctico Argentino; Brazil: Universidade de Rio Grande, Universidade de Sao Paulo, Chile: Universidad Austral, Universidad de Magallanes; and US: Biospherical Instruments, Inc., Environmental Economics Research and Application, Lehigh University, Universidad de Puerto Rico).

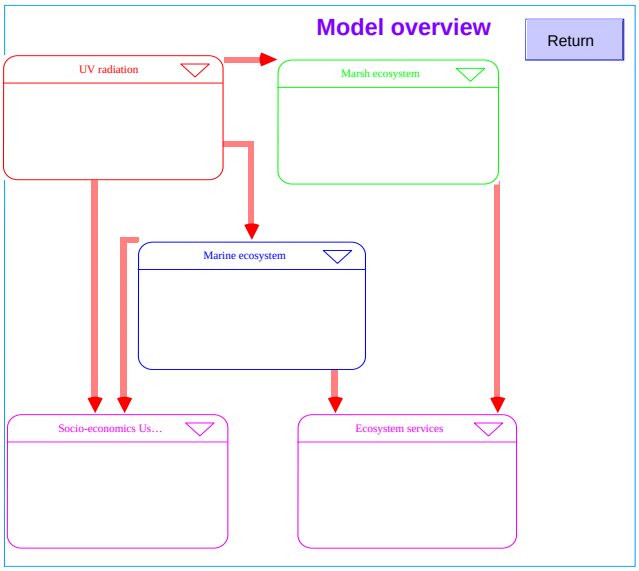


During the last year of funding in 2003-2004 we carried out the following several activities:

A. SCIENCE: Synthesis Meeting:
carried out from 29 March to 3 April 2004 in Buenos Aires, Argentina, with the participation of 23 Principal Investigators and Graduate Students and 4 invited Associated Investigators. A special volume in a scientific journal will publish the results from this meeting. The project has published more than 30 publications in scientific journals.

B. TEACHING: Doctoral and Master Degree Theses: the IAI provided funding for more than 9 theses in 4 countries (Argentina, Brazil, Canada, Puerto Rico, US) and other 7 graduate students received partial funding.

C: POLICY: Second Stakeholders Meeting: carried out in Ushuaia on 27 and 28 March 2004. Participation of members of society (business, teachers, medical doctors, media, etc.) was included in the scientific findings through two meetings and data modeling.com gathering that are summarized in a model. The model can be found at www.mediated-modeling.com



Questions developed during the workshop in Ushuaia in November 2000 to be addressed by the model

1. What are the direct and indirect socio-economics impacts of UV-b radiation?
2. Can we define a synergy or feedback mechanism between different sectors represented in the model; ecosystems (marshes/marine systems), education, tourism?
3. Does the response of UV-b on human health and ecosystem health change with temporal and spatial scale?
4. How does the time lag between CFC release and recovering of the ozone layer and ecosystem responses and human health effects manifest itself?
5. What is the influence of existing policies on local and global level? Are there solutions?
6. Does global warming need to be in the model and if so, can global warming be represented by temperature only?

CRN 031, ENSO Disaster Risk Management in Latin America: proposal for the consolidation of a comparative-regional social study based research, information and training network.

Allan Michael Lavell Thomas

The Project and Current Status:

The project is being undertaken in 8 countries (Argentina, Brazil, Ecuador, Mexico, Costa Rica, Colombia, Peru and Florida, USA.), with local researchers and institutions participating within the overall framework of the Latin American Network for the Social Study of Disaster Prevention-LA RED. The Project has promoted comparative research on changing risk patterns associated with ENSO over the last 35 years and the role of social as opposed to physical variables in such changes and the explanation of loss and damage; created a series of national and a regional data base on damaging events associated with ENSO and climatic variability in the 8 countries registered and presented at a high spatial scale of resolution (municipalities, districts, etc.); advanced in the construction of a regional internet based documentation system; provided grant incentives to postgraduate students for the completion of theses on the topic of ENSO and risk; and moved towards the publication of books and journal on the topic, based on research results. A training and educational module derived from the project results is pending commencement and completion during the present year-2005. The Project has clear policy implications and was designed with this important aspect in mind.

Some Important Results and Policy Implications.

1. The data base (DESINVENTAR) built up on all damaging events occurring due to hydrometeorological phenomenon over the period 1970 to 2003 in the different Project countries, is unique in the region. These data sets, covering ENSO and non ENSO years, allow analysis at a high scale of spatial resolution which is of use to national and local level decision makers and permits an understanding of changing temporal, spatial and semantic patterns of event occurrence and the attendant impacts at a social level. As such it is an invaluable, public domain source of information for policy makers, researchers and others.

2. Although most attention has been paid to the physical side of the ENSO equation (the climatic resources and associated hazard disturbances - excessive rainfall, landslides, drought, disease vectors etc.), in the short, medium and long terms the most important reducible and controllable impact on loss levels, risk and future disaster will be determined by the make up of social vulnerability and the resilience and capacity for adjustment and adaptation of society. Any consideration of the challenges for policy and practice associated with these phenomena must automatically integrate the discussion of "ENSO risk" with a more wide ranging consideration of such phenomena as annual climatic variability and future Global Climatic Change.

3. Amongst the major challenges for implementation of risk management practice relating to the Niño and Niña which derive from research results, the following may be considered:

    - the particular resource and hazard manifestations associated with these phenomena and their similarity or divergence from those associated with other aspects of climate variability. For Central American countries, for example, the types of hazards associated with ENSO are in fact common in the region under normal annual patterns of climatic variability, whereas in the north of Peru or north-west Argentina the ENSO risk patterns

are almost unique. These differences have much importance for decision making and the structuring of integral risk management practice.

- comparative national research results show varying temporal and spatial patterns of loss and damage during different ENSO periods. This changing spatial and social incidence of associated hazards in different Niño periods establishes a contradiction between the increasing ability to predict the occurrence of the ENSO phenomena at a global or national scale and the increasing difficulty of predicting particular impacts at the local scale. Moreover, local impacts are very much conditioned by human vulnerability patterns and changes such that the hazard side of the equation, which has received far more attention, increasingly assumes a lower predictive power as to loss and damage.
- the reconciliation of the contradiction between the local nature of risk and centrally, technocratically, controlled intervention decisions and mechanisms that make popular participation difficult and ignore local rationales and needs must be overcome;
- the need to consider the Niño in the light of climate variability and change and not as an independent and autonomous phenomenon, is crucial. Once more, results show that ENSO risk must be considered in the light of climatic risk in general. There can be no special ENSO risk management set up but, rather, an integral risk management system for the country or local area which takes into accounts not only ENSO risk but also other more recurrent risks. The patterns of social change and adaptation that occur under annual hazard conditions are part of the changing social matrix in which ENSO risk patterns exist.
- the time horizon associated with the phenomena which favors short term compensatory prevention mechanisms and response as opposed to medium and long term integral risk management schemes must be overcome.

4. Project results have been made available to different decision making sectors though conferences, seminars or publications or have been incorporated into new projects undertaken by team members in the different countries. The development of training and educational modules will permit more wide spread impact through such channels.

CRN 040, Comparative Studies of Global Change Effects on the Vegetation of two Tropical Ecosystems: The High Mountain and the Seasonal Savanna, "RICAS"

Juan Silva

The CRN-040 (RICAS) is now in the final phase, developing a few activities still to be completed and preparing for the final report. Field work is already finished and all results are being processed and prepared for publication. Still some students have not finished their dissertations and are expected to graduate this year. A meeting of CoPIs will take place in Merida, from 18 to 20 of April.

The project have four main components of research: a) Water dynamics in mountain forests and grasslands; b) Structural and functional responses to environmental and perturbation gradients in mountain ecosystems; c) Structural and functional responses to environmental and perturbation gradients in seasonal savannas; and d) Climate dynamics.

Our CRN is formed by scientists and students from four countries: Argentina, Brazil, Colombia and Venezuela. Furthermore, a PESCA project was developed with scientists from Cuba, and concluded successfully. Participation from Colombia was substantially reduced after the second year due to the crisis of the country.

Research activities have been the base to promote cooperation oriented toward institutional strengthening and capacity building. More than 25 exchanges of students and scientists as well as 10 short courses and workshops have been accomplished. A total of 27 students have participated in various capacities, as graduate students, college students and research assistants. Thus far, we have graduated 10 PhDs, 7 Masters and one Licenciado.

Water plays a fundamental role in determining the biological diversity and stability of tropical ecosystems and renders essential services to human societies. The influence of global change (the combination of climate and land use change) on the flows of water in tropical ecosystems and how the latter respond to these changes is a main topic of our project in two important ecosystems: the mountain forests and the seasonal savannas. Our research on the water dynamics in mountain forests and associated grasslands has been conducted in the Andean slopes in three countries, Argentina, Colombia and Venezuela. Our findings comprise: the water balance in these three ecosystems, the role of floristic composition (especially of the epiphytic community and the grasslands), and the consequences of the replacement of forests by different types of grasslands on changing water flows. This is particularly important in the context of catastrophic rainfall events.

In the seasonal savannas, we conducted a detailed analysis of the annual fluctuations in soil water at different depths along physiognomic gradients from woody savannas to open grasslands together with water flows. The replacement of native savannas, well known for their high biodiversity, by introduced pastures with higher water use efficiency and greater productivity deeply affects water circulation in the system. Particularly relevant is the reduction in soil water recharge and in soil available water for plant growth.

The various groups working on water dynamics celebrated an important workshop in Merida in June 2004. They concurred to present and discuss the results from the mountain forests of Tucuman, Sogamoso and Merida as well as those from the seasonal savannas of the Brasilian Cerrado. A booklet with the results of this meeting is now in press.

In addition, we have looked to water availability as a determinant of savanna structure and functioning. In this context, we study the ecology of savanna trees, the response of different species and functional groups to water availability as determined by rainfall, geomorphology and soil texture. The results will help to understand the nature of savanna vegetation, the coexistence of

exclusive growth forms like trees and graminoids, the role of fire and the responses of savannas to changes in rainfall and land use. This is likely to be important at the scale of regional climate, provided the extent of seasonal savannas in South America, their biodiversity and the rapid transformation of these ecosystems as a consequence of land use change. We have stressed differences between functional groups and between species at detailed levels such as germination, seedling growth and survival and seedling performance in water and carbon flows. Our results, together with others being published, show a complex picture of species-specific responses. We suggest that oversimplification and gross species classification in major functional types may be misleading and that more detailed analysis is needed to understand savanna responses to global change.

In previous reports we have detailed our results from the responses of paramos vegetation to environmental gradients and their relations to biodiversity, as well as the behavior of individual species and higher taxa. Especially important in this context are the results with the genus *Polylepis*, the highest growing tree. Both, paramos and *Polylepis* forests are experiencing high pressure from land use change. However, the diversity of functional attributes (which determines a high ecological resilience) found in the different species of *Polylepis* along the latitudinal gradient may explain some aspects of their success under different climatic scenarios. These communities play an important role in the water flows of high tropical mountains at the basin scale.

We develop three major data bases for Venezuela: plants from the paramos, plants from savannas and rainfall data. These are being made available in the web through IAIDIS.

We should remind here that one of the peculiarities of our research is the multi-scale approach, from the landscape to the individual plant. This approach allows us to get an insight in the processes and mechanisms involved in the responses of ecosystems to global changes. We expect to be able to integrate these views from different tropical ecosystems such as paramos, mountain forests and savannas to understand functional response to global change and the role of biodiversity.

Merida, March 31, 2003

CRN 047, The Andean Amazon Rivers Analysis and Management (AARAM) Project
Michael McClain

The AARAM project was a regional **research** initiative to develop the scientific understanding of Andean Amazon river ecosystems necessary for effective management in light of ongoing development programs and possible climate change. AARAM was a direct outgrowth of the IAI process, initiated in 1996 through the Start-Up Grants Program. The project was built on a foundation of scientific excellence and capacity building within a regionally-defined research framework of multinational and multidisciplinary collaboration, promotion of standardized data collection, and policy relevance.

We found that Andean Amazon rivers generally enjoy high water quality and intact ecosystems. We also identified problems of both degraded water quality and ecosystem integrity in the vicinity of towns discharging raw sewage to rivers and in areas of intense agriculture. While our results painted a generally optimistic picture of the present conditions in the region, they also identified a number of threats that must be addressed in order to maintain river ecosystem quality and function into the future. Untreated wastes from towns and poor land management in agricultural areas are the most widespread threats, while petroleum development and mining are important in certain regions.

AARAM demonstrated the impact that the IAI can achieve in supporting science across the region. Over the 5 years of the project investigators and students collected nearly 1000 water quality samples from more than 150 rivers. 15 rivers were chosen for detailed monitoring over the course of 1-3 years, enabling project scientists to determine relationships between seasonal and sporadic changes in discharge and water quality. Quantitative models of these dynamics were developed to guide continued research and decision making. More than 100,000 km^2 of the Andean Amazon landscapes were examined for land cover, land use, and climate parameters. In fact, 4 new methods of landscape analysis were developed in student projects. **Carlos Mena** (Ecuador – M.Sc. 2002) developed a technique for predicting the rates and patterns of deforestation from widely available socioeconomic data. **Alejandro Rosselli** (Colombia – M.Sc. 2002) developed an end-member mixing technique to identify and map aquatic habitats using Landsat imagery. **Daniel Gann** (Germany – M.Sc. 2003) developed a technique to distinguish regionally relevant land-use types from Landsat imagery. And **Marcelo Ayabaca** (Ecuador – M.Sc. 2004) developed a neural network approach to interpolate between climate stations to develop regional precipitation maps. AARAM also conducted important new research in the human dimensions of environmental change. More than 200 household surveys yielding information about the ways humans both depend upon and impact river ecosystems. Two projects of students from Peru (**Apacicio** – Ing. 2000) and Ecuador (**Delgado** – Ing. 2001) determined how people use water from rivers. **Rosa Cossio** (Peru – M.Sc. 2002) determined how colonists and indigenous people used riparian areas along rivers, while **Jorge Celi** (Ecuador – M.Sc. 2005) examined the status of more than 100 river sections and related river condition to nearby threats.

In all 33 students were trained within AARAM and of these most have either continued to higher levels of study or are working on water-related issues in the region. AARAM core funding leveraged more than $1 million in additional funds that have been used to establish a permanent research station in the region and to develop an internet data portal for data from the entire region. AARAM results have been and continue to be published in journal articles and book chapters and investigators and students have given nearly 50 scientific presentations across the region and in North America and Europe.

AARAM established facilities and infrastructure that continue to support global-change research in Peru, Ecuador, and Colombia. The Andean Amazon Research Station in Oxapampa, Peru, is gaining regional recognition as a center of research. The facilities are described in previous

sections and continue to be supported with funding from the Moore and MacArthur Foundations. We have also forged collaborations with other institutions in the region that will contract technical services from the station.

AARAM has also left behind important infrastructure in the form of new and refurbished meteorological and river gauging stations. We constructed two new climate stations in Peru and refurbished one station in Ecuador. In Peru the station in the national park is being turned over to INRENA, and in Ecuador the station is operated by INAMHI. AARAM constructed 5 new permanent river gauging stations and refurbished two stations in Ecuador. These stations are being monitored by staff of the Andean Amazon Research Station in Peru. In Colombia they have been turned over to the Universidad de al Amazonia, and in Ecuador they are being operated by INAMHI.

AARAM outreach activities mainly took the form of environmental education within local schools and the involvement of Earthwatch volunteers in our sampling activities. We involved students from nine Peruvian secondary schools in the GLOBE (Global Learning through Observations to Benefit the Environment) Program (www.globe.gov) and paired them with local scientists to create a hands-on learning experience. We equipped the schools with weather stations, and water and soil test kits to allow the students to participate fully within GLOBE and to interact with similar-age students from over 80 other countries that also participate in GLOBE. The most important innovation of this project from a GLOBE perspective was that it linked scientists already working in this region with school children and their communities to provide support for environmental research and management programs in their own region. Most schools participating in the GLOBE Program interact only with US-based scientists and then those interactions are exclusively via internet.

These activities were a collaborative effort between Florida International University, the University of Miami, and the National Agrarian University of Peru. Students and teachers from the participating schools made environmental measurements and incorporated the monitoring activities into an environmental curriculum tied to the GLOBE program. This curriculum has been designed to facilitate the learning of science by use of the inquiry process. Its learning activities use data collection as the point of departure to broaden the students' environmental knowledge and perspectives through communication with fellow students around the world and with scientists who utilize the data in their research.

AARAM, in Oaxpampa, Peru, also co-hosted the local 2004 World Environmental Day celebration. This included a parade in which the students of our environmental education program participated.

During 2001 and 2002 we fielded 8 teams of Earthwatch volunteers (www.earthwatch.org) investigating aquatic biodiversity in the region and relating this biodiversity to the resource needs of local people. At total of 35 volunteers from North America, Europe, and Asia participated. They included teachers and professionals from many disciplines including banking and internet commerce.

CRN 048, Diagnostics and Prediction of Climate Variability and Human Health Impacts in the Tropical Americas

Ulisses Confalonieri

The project is concerned with the identification of linkages between climatic factors (temperature, rainfall, humidity) and land use/land cover changes and the seasonal and interannual dynamics of infectious diseases, with a focus on malaria and dengue fever. The major application of the expected scientific results will be in the design of climate-health early warning systems, in order to protect human lives and health and also with the aim of optimizing scarce resources from health systems in developing countries in the Americas.

Six countries are in involved: Brazil, USA, Mexico, Colombia, Jamaica and Venezuela.

So far, the major achievements to be highlighted are:

1- Linkages between ENSO and malaria in Colombia and the development of a Geographical Information System for the study of malaria and climate.
2- Association of dengue epidemiology with climate variability in the Caribbean islands and in southern Mexico.
3- Identification of social-environmental vulnerability factors to malaria in northern Amazonia (Brazil).
4- The role of ENSO-induced drought as a constraint for malaria transmission in parts of the Brazilian Amazon.
5- Linkages between population dynamics of mosquito vectors of malaria and meteorological variables in Venezuela
6- Understanding of the meteorological/hydrological influences on the breeding sites of mosquito populations in savanna and forest areas in the Amazon (Brazil).

CRN 055, PROSUR: A regional *PRO*gram for the Study of Regional Climate Variability and Changes, their Prediction and Impact in the MERCO*SUR* Area.

Mario Nunez

Principal Investigator: Mario N. Nuñez (Argentina). Co Principal Investigators: Vicente Barros, Guillermo Berri, Matilde Nicolini, Walter Vargas and Carolina Vera (Argentina). Tercio Ambrizzi, Iracema Cavalcanti, Alice Grimm, Jose Marengo, Carlos Nobre, Maria Asuncao Silva Dias and Pedro Silva Dias (Brazil). Genaro Coronel (Paraguay). Mario Bidegain and Mario Caffera (Uruguay). Hugo Berbery, Henry Diaz and Brant Liebmann (USA).

PROSUR has been honored as an affiliated program of CLIVAR/VAMOS.

A multinational and interdisciplinary team has established to promote research into the causes of climate variability and changes in the MERCOSUR region of South America. Scientists from Argentina, Brazil, Paraguay, Uruguay and the United States belonging to research and university institutions are participating in the regional network. The main objectives of the Program are focused to support an environment conducive to collaborative research in climate variability and climate changes. This is accomplished by sponsoring scientific visits to each of the participating institutions holding regular meetings where results are disseminated and discussed, and by encouraging the free exchange of data. Also, is proposed by the Program, the promotion of the capacity building in the participating institutions, mainly in those with scarce development in the scientific interest area of the Project. The exchange of scientists and students is strongly promoted, searching for alternative funds for post degree fellowships. The interchanged data have already been useful in several diagnostic studies undertaken by scientists within PROSUR.

The goals for the Project are:

1. Promote the research and interactions among PIs on the floods in La Plata Basin;
2. To promote studies on the physical and dynamical processes of extreme events in the MERCOSUR area;
3. Assess the degree of understanding of these extreme events by stakeholders and population;
4. To develop and support activities related to South American Low Level Jet Field Experiment
5. Support modeling studies to investigate regional climate variability and changes.

The overall achievements during the four reported years are summarized next:

- More than 200 Journal articles/book chapters were submitted or published
- Organized 4 workshops with specific PROSUR agendas. Boulder (USA), Asuncion (Paraguay), Mar del Plata (Argentina) and Cruzeiro (Brazil) workshops produced presentations/extended abstracts and can be consulted at the CRN 055 PRSOUR internet site (http://prosur.cima.fcen.uba.ar)
- More than 50 scientific visits to further ongoing collaborations
- PhD, MSc and under-graduate fellowships were granted and partially supported by the project
- Modeling research activities results from the Project helped to produce *regional climate change scenarios* for Second National Communication on Climate Change of Argentina. The CoPis of Uruguay are at the present implementing a regional climate model to obtain also climate scenarios. Expected results will used in the Third National Communication of Uruguay.
- A book on Climate Variability of Southeastern South America is nowadays under preparation, including the CRN research results. The book will cover an existing gap of Climate Scientific Texts for South America.

All the efforts involved the collaboration and interactions of scientists and graduate students from the different research units participating in PROSUR. Below a list of students partially of fully supported by the project

País	Nombre	Posgrado/grado	Universidad	Ayuda IAI	Finalizado
Argentina					
Berri, G.	Pablo Antico	PhD	UBA	parcial	Sí
Berri, G.	Germán Bertossa	PhD	UBA		
Nicolini, M.	Paola Salio	PhD	UBA	parcial	Sí
Barros, V.	Moira Doyle	PhD	UBA	Fellowship	Sí
Barros/Vera	Gabriel Silvestri	PhD	UBA		Sí
Barros	Adriana Fernández	PhD	UBA	parcial	finalizando
Nuñez, M.	Norma Possia	PhD	UBA		finalizando
Nuñez/Vera	Cerne, Bibiana	PhD	UBA	parcial	
Nuñez/Ambrizzi	Müller, Gabriela	Phd	UBA/USP	fellowship	finalizando
Nuñez, M.	Simionato, Claudia	PhD	UBA	parcial	Sí
Nuñez, M.	Viale, Maximiliano	Licenciatura	UBA	parcial	
Vera, C.	Gonzalez, Paula	Licenciatura	UBA	parcial	
Vera, C.	Palastanga, Virginia	Licenciatura	UBA	parcial	Sí
Vera, C.	Campetella, Claudia	PhD	UBA	parcial	
Berbery, H.	Collini, Estela	PhD	UBA/UM	parcial	
Brasil					
Cavalcanti, I.	Rodrigues, Daniel	MSc			Sí
Cavalcanti, I.	Castro, Christopher	MSc			Sí
Cavalcanti, I.	De Souza, Cleber	MSc			
Cavalcanti, I.	Andrade, Kelen	MSc			
Nobre, C.	Obregón P., Guillermo	PhD	INPE		Sí
Nobre, C.	Oyama, Marcos Daisuke	PhD	INPE		Sí
Nobre/Seluchi	Carneiro, Gláucia Meira	MSc	INPE		
Nobre/Marengo	Pesquero, José	PhD	INPE		
Marengo, J.	Rodrigues Soares, W.			fellowship	
Silva Dias, Maria	Macedo B., Rodrigo	MSc	USP		Sí
Silva Dias, Maria	Sias, Estael		USP		Sí
Silva Dias, Maria	Silva, María	PhD	USP		Sí
Silva Dias, Maria	Herdies, Dirceu	PhD	USP		Sí
Grimm, A.	Natori, Angela	MSc	USP		Sí
Grimm, A.	Ferraz, Simone	PhD			
Grimm, A.	Leite, Alvaro				
Grimm, A.	Toglatian, Isabela				
Grimm, A.	Tedeschi, Renata				
Grimm, A.	Macena M., Henrique				
Grimm, A.	Pscheidt, Ieda				
Ambrizzi, T.	Drumond, Anita	PhD	USP	fellowship	
Ambrizzi, T.	dos Santos Coelho, C.	MSc	USP		Sí
Ambrizzi, T.	Pezza, Alexandre	PhD	USP		
Ambrizzi, T.	de Souza, Everaldo	PhD	USP		
Silva Dias, P.					
Silva Dias, P.					
Uruguay					
Bidegain, M.	Renom, Madeleine	PhD	UBA	fellowship	

Fellowship: Tiene beca del IAI CRN 055 al menos por un período de 6 meses
Parcial: Recibe ayuda del IAI CRN 055 por *menos* de 6 meses o se le pagan viajes a congresos del CRN o visitas científicas.

Miscellaneous Most of the scientists collaborating in the CRN have participated actively in regional field experiments such as the South America low level jet experiment (SALLJEX). Also, some of the CRN CoPIs and collaborators are now participating as Principal Investigators in CLARIS, a Europe – South America cooperative research network, supported by the European Commission.

CRN 061, SACC: An International Consortium for the Study of Global and Climate Change in the South Atlantic

Edmo Campos

The main accomplishment of the CRN061 Project was the consolidation of a network of scientists and institutions in Argentina, Brazil and Uruguay, fo the study of global change research in South America. A quick list of the most important achievements follows.

1. Scientific Research

1.1 Basin scale general circulation and climate studies:

a) Science issues:

- South Atlantic role on interocean exchanges and global thermohaline circulation
- Mechanisms of South Atlantic interannual SST variability
- Southwestern South Atlantic fronts variability

b) Related Activities

- Promotion of South Atlantic Climate Observing System (SACOS) Workshop
- Active participation in Scientific conferences with the presentation of several articles.

1.2 Regional Studies

a) Science issues:

- Plata River impact on the SW Atlantic shelf
- SW Atlantic shelf modelling
- Seasonal and interannual variability of Shelf break front

b) Related Activities

- Conduction of interdisciplinary field work, including oceanographic cruises and airborne surveys – **highlights:** activities without precedent in Latin America; strong scientific basis; state of the art instrumentation; very strong impact on the scientific knowledge and on the interaction among participants; expressive involvement of several graduate students;
- Participation in various scientific conferences, with several invited papers.

2. Training and education activities

- Short Courses: Four advanced, international short courses, attended by over 80 students from several IAI member countries. All of them highly competitive, international and interdisciplinary.
- "On board" short courses: Taking advantage of the PLATA oceanographic cruises, two practical courses were offered, mainly for undergraduate students, for their first ever sea goind experience.
- Fellowship program: highly competitive, international, interdisciplinary. Provided support for more than 40 young scientists and graduate students.

3. A summary of the publications (*as of Dec/2004 – subject to changes)*

Type of the Publication	Quantity
i) Articles published (since year 2000)	**45**
ii) Articles accepted/in press	**5**
iii) Articles submitted (under review)	**9**
iv) PhD Dissertations defended (since 2000)	**8**
v) MSc theses defended (since 2000)	**4**
vi) Theses and Dissertations in preparation	**10**

4. Other impacts on scientific development

- The realization of five Annual Workshops have considerably increased the exchange

of scientific ideas and helped to spread information on ongoing research. These were open to many non SACC scientists and advanced students from a broad spectrum of disciplines, including human dimensions, and members of other CRNs.

- Travel support for several short visits to other labs, serve thesis committees, serve international panels, etc.
- Library upgrade essential to many institutions
- Acquisition of equipment, mainly computer and other related pieces of hardware.

Support from the IAI has also been a solid basis for preparation of research proposals to national agencies, which have provided very significant in-kind contributions.

Short Report as of April/2005

CRN 062, Eastern Pacific Consortium for Research on Global Change EPCOR
Timothy Baumgartner

The Eastern Pacific Consortium for Research on Global Change in Coastal and Oceanic Regions (EPCOR) is a collaborative network of the IAI (CRN 062) comprised of research and education centers in Chile, Peru, Ecuador, Colombia, Costa Rica, Mexico, the United States and Canada. The overarching goal of our CRN has been to develop a sustained capacity for collaborative research and scientific development among institutions, scientists, and decision makers in the countries bordering the eastern Pacific. Annual planning and specific budgeting is the responsibility of the EPCOR Executive Committee comprised of scientists from all of the member countries. The ExCom is headed by the Scientific Director (the CRN-PI) and an Executive Scientist. The administration and financing of the individual EPCOR projects and activities with IAI funds are undertaken by our office located at CICESE, Ensenada, Mexico.

The overall objective of our CRN is to evaluate and anticipate the impacts of global change on coastal and oceanic ecosystems, along with their social and economic consequences. This includes the combined effects of natural climate variability, human-induced changes on the natural climate system and direct human intervention on coastal and oceanic marine ecosystems through harvesting and other types of habitat alteration.

Although the IAI support for CRN 062 is scheduled to end in July, 2005, EPCOR will continue as an entity to foster long-term Inter-American research collaboration. To accomplish this we have created alliances with major international programs through development of a broad, multidisciplinary science agenda that is designed to implement the goals and plans of these programs such as IGBP (core projects of GLOBEC and PAGES), CLIVAR of the WCRP, and GOSS program of IOC. We are also in the process of building a solid partnership with CIIFEN now located in Guayaquil, Ecuador which is now developing a scientific agenda that strongly overlaps with the goals and objectives of EPCOR. Our CRN has also made a significant contribution to development of funded and pending research proposals from agencies outside the IAI that support the scientific agenda of EPCOR and the IAI.

Through our research and outreach activities, we are contributing to strengthening regional capacities for assimilation of emerging scientific understanding and related sustainability issues into the process of adapting to the regional social and economic consequences of global change. Education and training of future generations of scientific leadership is also a critical process of assimilation of new scientific understanding, and EPCOR has contributed with a scholarship program for post-graduate studies at the M.S. and Ph.D. level. The scholarship program has and is supporting students from Colombia and Costa Rica, for studies at the University of Concepción, Chile, and students from Chile and Perú at CICESE in Mexico, and from Ecuador at CICIMAR in Mexico. We have also provided support from science-exchange funds to Ph.D. students from Mexico to benefit from periods at CICESE and at Oregon State University. We have organized and/or contributed to a number of special training courses for members of EPCOR collaborating institutions such as a course for use of Acoustic Doppler Current Meters at IMARPE, Peru (organized by EPCOR) and the bi-annual Satellite Oceanography course at CICESE (supporting contributions).

The principal EPCOR activities are organized according to the following structure:

- Networking: Workshops, Science Exchanges
- Research Implementation, Based on Science Modules:
  1. Retrospective-comparative studies to create knowledge base,
  2. Modelling diagnostics at the basin- and regional scales,
  3. Regional ocean surveys
  4. Coastal monitoring networks

5. Regional satellite studies and monitoring programs
- Information and Data Exchange
- Education and Training Activities

For more detailed information, please consult our website <http://epcor-iai.cicese.mx/> which in the process of being updated with current activities and results. This update will be completed by end of April, 2005.

Tim Baumgartner
12 April, 2005

CRN 073, Climate Variability and its impacts in the Mexico, Central America and Caribbean Region

Víctor Magaña

In recent years there has been substantial progress in our understanding of global climate and the mechanisms that modulate part of its variability. Several studies on the impacts of El Niño around the worlds have led to establish climate prediction systems to ameliorate the negative impacts of potentially adverse climate or to take advantage of probable adequate climate conditions. In order to make true the previous statement for the Mexico, Central America and Caribbean region, a Collaborative Research Network was created with the participation of scientists from the US, Mexico, Costa Rica, Colombia, Cuba and Jamaica.

In order to make climate forecasts or climate information in general, a valuable element in de the decision making process of different sectors it was important to examine the characteristics of the annual cycle of precipitation and temperature in the region. For instance, there are certain aspects of climate in this region that have been known for a long time by people but have not found a scientific explanation. This is the case of the so-called Mid Summer Drought (MSD), a relative minimum in precipitation in the middle of the rainy season (July and August). This is not a real drought, but a period of slightly less rain than the other summer months (June and September). The area of influence of the MSD covers most of Mesoamerica. Farmers in the region explicitly request information on the intensity of the MSD since it may influence the productivity of crops like maize.

The MSD appears to be related to the dynamics of atmospheric circulations over the Caribbean Sea. In particular, the existence of a low level jet is crucial in the characteristics of climate along the Caribbean and Caribbean coast of Mesoamerica. CRN 73 concluded that in order to improve climate predictions in the region it was necessary to explain the mechanisms that result in the annual cycle of precipitation by examining the dynamics of the MSD and the Caribbean Low Level Jet. This objective constituted a challenge due to the scarcity of data in the over the warm pools that surround Mesoamerica. With the support of the National University of Mexico through the financed use of its oceanographic vessels, a field campaign to study climate over the Americas Warm Pools (ECAC) was conducted in the summer of 2001.

The data obtained during ECAC has served to examine the dynamics of the MSD. An improved theory for the MSD has recently been put forward by Magaña and Caetano (2005) based on the data collected. New research has been developed to explain the dynamics of the MSD in terms of direct zonal circulations that result in teleconnections between the Northeastern Pacific and the Caribbean warm pools. The Caribbean Low Level Jet appears to play a role in the teleconnection via exchange of energy with easterly waves that travel from the Caribbean to the Pacific or through the gap flow across the Papagayo Isthmus that cools the NE Pacific warm pool.

The complex interaction processes have spatial scales that cannot be well resolved by current General Circulation Models used to predict seasonal climate anomalies. However, such spatial details are necessary for decision makers to plan their activities considering climate information. The CRN 73 scientists have implemented a regional climate model that combines the NCAR CCM3 and the mesoscale model known as MM5 to explore the possibility of reproducing such small scale features. In addition, an ensemble prediction system is being tested to construct the probability density functions that better represent the probabilities of significant anomalies in climate or those of exceeding a threshold value in some climatic parameter that results in negative impacts in a socioeconomic sector.

The CRN73 participants have found that making use of climate information in various sectors is not an easy task due to the limited capacity in climate risk management among stakeholder. Consequently, in this final stage of the project, they are looking for mechanisms to communicate

climate information in terms more easily handled by decision makers. This goal constitutes a capacity building process in the region and will certainly require various years for stakeholders of the region to understand the value of a seasonal climate forecasts.

Several students are being trained in the fields of climate dynamics, climate forecasts, use of climate information and climate risk management so that they can help in the process of constructing useful climate information. So far, three Ph.D. candidates, ten MSc students and at least ten BSc students will obtain their degrees by making use of the results of the CRN73 projects. Most of the PIs maintain close collaboration and thanks to the improved understanding of the climate in the region, they have been invited to participate in Scientific Advisory Committees for various regional climate projects such as the North American Monsoon Experiment, a regional project financed by GEF on capacity building in the climate change adaptation process and some potential new initiatives as the Intra Americas Seas Program (NOAA).

In almost every CRN73 participating country, government officials frequently request the advise of their scientists, mainly on matters related to climate, water, agriculture and forests. This has made CRN73 a reference point for studies on climate variability and change.

In the following (last) year, CRN73 scientists will concentrate on publishing the results of their activities, since most of them have only been presented as preliminary ones.