IAI´s Mission

is to develop the capacity to understand the integrated impact of present and future global changes on regional and continental environments in the Americas and to promote collaborative research and informed action at all levels. (IAI Scientific Advisory Committee, 1997)

IAI Member Countries as of June 30th, 2006

Argentina

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Chile

Costa Rica

Dominican Republic

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Mexico

Paraguay

United States of America

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Bolivia

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Editorial

Holm Tiessen

During 2005-2006, the first round of Collaborative Research Networks (CRN I) has been completed. The IAI has now embarked on synthesizing its results with the help of the scientists involved and invited experts. The first of these analyses explored issues of policy and societal relevance of global change research with input from experts on communication, policy, institutions and legal frameworks at a workshop in Ubatuba, Brazil in December 2005. The results of this analysis will be published as a book: SCOPE 68, edited by H. Tiessen, G. Breulmann, M. Brklacich and R.S.C. Menezes, to be published in 2007 by Island Press, Washington. A policy brief has also been published: UNESCO-SCOPE 2006. "How to improve the dialogue between science and society: The case of Global Environmental Change. December 2006 – No. 3. UNESCO-SCOPE, Paris Author: Holm Tiessen, IAI Editor: Ana Persic, Design: Ivette Fabbri. With this process, the IAI is developing critical links between its science programs and society and policy sectors. This is an important part of its mandate as pointed out in the 2004-2005 editorial by John Stewart and Gustavo Necco below.

Some of the lessons from this evaluation of policy and societal impact can be summarized as follows: as global change increasingly affects societies' wellbeing and development, science becomes an important input to policy. Global change science is not only asked to investigate current environmental phenomena, but also to predict the rate, shape and extent of global change, provide decision aids for mitigation and guidance towards adaptation. This

policy link is not part of the traditional roles of scientists, and the move towards greater societal relevance does not happen in a linear or planned process. The CRN lessons may help to improve and guide the random advances as scientists and research institutions react to changes in funding, attitudes and policies. Early engagement of scientists across disciplines and policymakers at the initial framing of the research questions helps build trust in both the science and policy process. Many CRNs started out without a policy agenda but developed one during the course of the project as opportunities arose, particularly as researchers were exposed to societal needs across cultures and country perceptions. The international and multidisciplinary nature of the CRNs was therefore a major factor contributing to societal relevance and outreach. An important lesson for funding agencies and science governance was that it is a difficult experience for many scientists, that to be policy relevant, good science is not enough. Traditional scientific or academic reward systems do not provide incentives to overcome this hurdle but, instead, discourage interdisciplinarity and policy engagement. Clearly, science governance needs to adjust to new demands as well, and some of the basic metrics used for science review may need adjusting.

The policy assessment from the Ubatuba meeting will be followed by 3 more workshops: on land use and climate held jointly with the Brazilian Weather and Climate Prediction Centre (CPTEC); on "risk" and vulnerabilities together with the new UN International Strategy for Disaster Reduction (ISDR) office in Panama; and on the application of ecological knowledge to land use decisions together with Inter-American Institute for Cooperation in Agriculture (IICA) in Costa Rica. Together, these workshops will not only provide a forum for synthesizing the science output from the IAI's CRNs, but will also provide important new institutional cooperations for the IAI with other international agencies.

At the same time, the implementation of the second round of CRNs (CRN II) is aided by input from the CRN I analysis. Neither natural nor social science alone will suffice to generate "relevant" science – dialogue and collaboration between the disciplines is a pre-requisite. In the new CRN II, synergies between projects and teams are explored, several of the projects are cooperating, some are sharing sites and research protocols, and the social sciences play a greater role than in CRN I. Improved interdisciplinarity and better interactions are already generating exciting science.

Administratively, CRN II is very different from its predecessor. New grant agreements containing many of the lessons from problems in CRN I have replaced the learning-by-doing administration of the previous program. CRN I was the first such complex international program of its kind, and all participants learned "on the job". As a result, several PIs and their administrators, as well as the IAI, have had to deal with numerous unforeseen problems of accounting, reporting and coordinating research. More elaborate but clear agreements, initial meetings with all PIs and institutional representatives, and an open dialogue on the needs and expectations of the program partners will provide for smoother operations and lower transaction costs for all. This is important since administrative problems make it harder to do good science and maintain long-

term support (and good-will). The Directorate with major help from the Financial and Administrative Committee (special thanks to Vanessa Richardson and Louis Grittani) has therefore invested a lot of time and effort to achieve much greater clarity and transparency in this more mature second program and we all look forward to more of the excellent science we saw in CRN I. The project management manual, completed in 2005 has been an important basis for this process.

Holm Tiessen,
Director (Since September 2005)

Gustavo V. Necco

John W.B. Stewart

The IAI's past fiscal year was one of transition and development marked by changes in staff and management, conclusion of the first phase of IAI's collaborative programs, and launching of new science and training activities, to mention a few of the events. Thus, it is a good point at which to examine how the Institute can be more relevant to its member countries, not only in furthering the study of quite complex scientific issues associated with global change, in developing a cadre of individuals throughout the region who can take steps to ameliorate the negative effects of such changes, and in fostering a strong involvement and engagement by member countries and representatives into the Institute's activities. This is no easy task — no one yet has the answers, but glimmers of direction and understanding are visible in several areas and must be explored and enlarged upon.

It will help if the year's progress is put into perspective. IAI has been pleased and proud of the scientific achievements of both its small and large funded projects as well as the range of successful training institutes developed in this period. Both science programs and outreach training institutes have been

quite remarkably productive and outstanding by any guidelines. However, these programs also must be useful in a very practical sense to stakeholders, whether they are governments, municipalities, fishermen, energy providers, or land users. Our attention in the future must focus on both scientific excellence and regional relevance.

It is interesting to observe the scientific directions that emerge from initiatives such as the Millennium Assessments and ongoing Intergovernmental Panel on Climate Change (IPCC) work, both of which fully engage governments and must be of value to them. Other, less publicized, initiatives are also worthy of mention. For example, Brazil is proud of its successful Large-Scale Biosphere-Atmosphere Experiment in Amazonia (LBA) science program that studies aspects of the changes taking place in the Amazon region. An offshoot of that program is the modelling initiative GEOMA project, which attempts to model and predict the outcome of various development strategies in the region. This program is designed to assist government-planned regional development and thus is not focused on publication of scientific results. The IAI's mission is to both develop good science and create links with government policies; although to date we have been more successful with the more traditional of the two approaches, the time is ripe to place more emphasis on translating good science into good policy. We can develop the interaction with stakeholders without losing sight of the fact that this approach must be based on excellent science.

The IAI plans to use its science strength — amplified by the success of its Training Institutes — to move the IAI program to a new level of regional relevance. In doing so, it hopes to engage decision makers in a meaningful way and to learn from the successes of the past decade.

Executive-Level Activities

One of the major issues at the Nineteenth Executive Council (EC) and Eleventh Conference of the Parties (CoP) meetings, held in Buenos Aires, Argentina (June 29 – July 2, 2004), was a recommendation to implement a second round of the IAI Collaborative Research Network (CRN-II). The Twentieth Meeting of the IAI EC and the Twelfth Meeting of the IAI CoP, held in Montreal, Canada, (May 2 – 6, 2005), discussed the ways to improve links between science and policy and requested that the IAI Directorate schedule a joint EC-SAC (Science Advisory Committee) meeting during the first quarter of 2006.

The CoP also approved Brazil's National Institute for Space Research (INPE)/Center for Weather Forecasting and Climate Studies (CPTEC) proposal to become an Affiliated Institution of IAI for the Program on Climate Variability in the Americas and proposed to hold a science-policy activity on an annual basis, depending on the availability of funds. In addition, the CoP elected the new members of the SAC and elected Dr. Holm Tiessen as the new IAI Director for a three-year term. Lastly, the CoP agreed with the proposal of Mexico to register

IAI in the United Nations Framework Convention on Climate Change (UNFCCC). Thanks to the collaboration of the Mexican delegation at the UNFCCC Tenth Conference of the Parties, held in Buenos Aires at the end of 2004, IAI had the opportunity to present an exhibit and distribute information. The IAI has now applied for observer status at the UN Meeting of the Parties to the Kyoto Protocol (CoP/MOP) in Montreal, Canada.

Management and Administration

The IAI Directorate, as a part of its effort to sustain the programs and provide continuity for the Institution's activities, developed and strengthened procedures and policies for management and operations. A particular effort was made to improve all administrative processes to ensure correct internal controls. The basic policies and procedures used by IAI staff and awardees were also reviewed and updated. These updates incorporate lessons learned from the management and implementation of previous research programs (ISP, PESCA, CRN). As a result, the implementation of the recent Small Grant Programs (SGP-I and SGP-II) has not faced any major administrative difficulties.

Given the tight schedule for implementing CRN II, the Directorate increased its interactions with the SAC regarding timelines, operational schemes, and procedures, as well as with the EC/Financial and Administrative Committee (FAC) in connection with financial and managerial aspects. To ensure a more homogeneous and consolidated set of rules for managing the research activities, a Project Management Manual and a related improved Grant Agreement were developed. These tools will be cornerstones for the management of all future IAI research activities; they also successfully fulfil a mandate from the constituent bodies and, particularly, from potential financial supporters.

IAI was pleased by substantial and useful assistance from the US National Science Foundation (NSF) staff and has benefited from the deliberations of a dedicated FAC in substantially revising the Employee Manual and Project Management manual. The new guidelines have improved all program and management tasks. These manuals were submitted to the FAC for review, and final approval was obtained for both manuals in June 2005.

In addition, IAI carried out personnel searches and new appointments: Director Dr. Gustavo Necco resigned as of December 2004. Dr. John Stewart was appointed as Interim Director for the period January – June 2005. In the early part of 2005, the IAI Director Search Committee convened at IAI and interviewed candidates for the vacant Director position. Dr Holm Tiessen, who has a long history with IAI as a researcher and CRN Principal Investigator, was elected the new Director.

It took approximately six months to successfully complete the program manager search following the departure of Eduardo Banus in December 2004. Ione Anderson, formerly with the UN Secretariat of the Convention on Biological

Diversity (UNCBD) in Montreal, has joined the IAI.

In addition, Celine Demaret Leite has joined the IAI Directorate in February 2005 to assist in developing the IAI Training Institutes.

Financial Issues

At the end of fiscal year 2004/05, 8 of the 19 member countries had not yet paid their country contributions. However, because several countries paid overdue contributions during this period, and because the largest contributors have unfailingly supported the IAI, the organization entered the 2005/06 fiscal period on a sound financial footing. Despite this positive news, the total shortfall in country contributions now amounts to US$600,000, which is of great concern to the directorate and makes it difficult for the IAI to fulfil all of its commitments. Consequently, a committee has been formed to address these financial issues. Proposed solutions focus on both rekindling the interest of individual member countries and demonstrating the substantial benefits these nations have received through project funding and other science support.

Science Programs

The completion of its first round of CRN-I projects provides IAI an opportunity to assess its accomplishments in several ways. The program can be analysed by the usual scientific methods: determining the number and quality of papers published, scientists trained, conferences attended, etc. The IAI intends to begin its assessment in this manner, but then take the process a stage further by assessing the impact of the research. Several IAI projects have significant extension and policy components (for example, CRNs on land use, fisheries, disasters, etc.), others have synthesised scientific findings to a high level of advocacy (for example, the CRN on biodiversity used for input to the millennium assessment). The often-missing link between science and governance also has been partially established by several projects. IAI is particularly interested in examining the projects that have successfully managed to present their scientific results in relevant and useable forms to both government and public entities. In December 2005, a joint workshop with the Scientific Committee on Problems of the Environment (SCOPE) was the starting point for evaluating the integration between natural and social sciences and examining the policy relevance of the CRN I.

The CRN-II, a five-year program, is designed to create networks of scientists throughout the region who will work collaboratively on global change problems of importance to the Americas. The program has been launched and 93 pre-proposals were submitted; following a pre-selection and review process, 37 full proposals were received.

The Small Grant Program (SGP-I) concluded this past fiscal year and all

final reports were received. The projects funded under the SGP-II Program, which started in April 2004, are also nearing completion, but a few projects were extended at no extra cost to IAI.

The Science Update portion of this report includes brief summaries of IAI's Collaborative Research Network projects. In addition, researchers describe two specific projects and one Training Institute in more detail: Cattle Ranching, Land use, and Deforestation; Urban Mobile Emissions in South American Mega cities; and the global Environmental Change Training Institute on Globalization and Food Systems.

Training and Education

Two very successful IAI Training Institutes (TIs) were implemented — one in Mexico and another in Costa Rica — and are described in more detail within the Training and Education section of this report. In addition to managing the TIs, the Training, Communications and Outreach Officer worked on a series of efforts to gain complementary funding, without which the training events could not have taken place.

"The IAI-IHDP Global Environmental Change Institute on Food Systems and Globalization — Scientific Workshop and Science-Policy Forum" (October 24 – November 6, 2004, Nicoya and San Jose, Costa Rica). This training opportunity received, in particular, considerable financial support from IHDP ($20,000), Research Council of Norway ($18,800), APN ($15,000), ISSC ($5,000), IICA ($3K) and IAI ($50,000). The total financial resources leveraged were $61,800. An estimated total value of $84,000 came from important in-kind contributions from other partner organizations and collaborators: IHDP ($44,000), CICERO ($22,000), Rutgers University ($10,000), NEF and OdD/UCR ($1,600), FAO (approximately $4,000) and CRRH (approximately $3,000).

Other institutional collaborators in organizing this activity were the University of Costa Rica – Foundation for Research (FUNDEVI), National Center of Advanced Technology Foundation (FUNCENAT), National Academy of Science of Costa Rica (NAC-CR), and Centro Mesoamericano de Desarollo Sostenible del Tr?pico Seco (CEMEDE) of the National University of Costa Rica (UNA).

The "Training Institute on Urbanization and Global Environmental Change in Latin America" (held in Mexico City, Mexico, September 27 – October 8, 2004) received $10K in financial support from IHDP and approximately $10K, as well as in kind contributions, from Mexico's National Institute of Ecology (INE). Other fundraising efforts through contacts with UNEP in Mexico helped co-sponsor this activity. The total of financial resources leveraged up until July 2005 was $20,000.

Two new TIs were planned for 2006: "Vulnerability Associated with

Climate Change and Climate Variability," held in Asuncion, Paraguay, October 17 – 28, 2005, co-organized with the National University of Asuncion, and "Climate and Health in the Americas," held in Kingston, Jamaica, November 7 – 18, 2005, in collaboration with the University of West Indies.

Brazil's INPE/CPTEC proposal — approved by the CoP in 2004 — will develop the joint INPE-IAI Research Internship Positions, a program for 6 research internship positions in Climate Variability in the Americas at Brazil's CPTEC. The internship program will provide an opportunity for Masters and PhD candidates and other young scientists to pursue their interests in this topic and related sciences and to apply their previous training to research. The plan is to begin developing this activity in 2006.

In 2004 – 2005, IAI and NCAR launched a similar program for post-doctoral support in atmospheric and related sciences to be developed at NCAR in 2006. The two organizations also agreed to establish a series of Joint Colloquia on Policy Planning and Decision-Making Involving Climate Variability and other relevant themes of the IAI science agenda to be implemented in 2006-2007.

The University of Goettingen, in partnership with the German Academic Exchange Service (DAAD), has collaborated with the IAI in the development of a summer school on "Integrated Resource Management in the Tropics" to be held in Goettingen, Germany, for students and researchers from Latin America. This training course, an initiative by the new IAI Director, who is a former professor at the University of Goettingen, held its first session in 2005.

Information Technology

In addition to developing a new brochure, the Information Technology Manager (ITM) has upgraded the IAI Web Page to make it more "user friendly." The system's new features and services include directions that improve the efficiency and speed with which scientific and institutional information can be obtained from the website and the IAIDB page.

The ITM visited and participated in a special training session at the Oak Ridge National Laboratory in February 2005 to discuss operational aspects of the new Data Information System (DIS) that IAI contracted from Oak Ridge. The new system will be used to manage all aspects of scientific and financial reporting of new awards and applications. In addition, as the research community becomes more accustomed to handling and reporting metadata, this site will provide a most valuable resource. The Education and Outreach section of this report provides more details about the DIS.

The IAI is pleased with results from the first phase of the IAI programmatic development (completion of CRN I) and excited by the prospect of embarking on a new phase of science programs and capacity building

activities. By strengthening our administrative base with revised and updated manuals and agreements, we have improved the management of IAI activities as a whole. We would like to thank the many individuals and institutions that have supported the IAI and have worked with us to further our mission — they are scientists, representatives of member countries, members of the IAI council and bodies (EC, CoP, SAC, FAC, for example), governmental agencies, partner and donor organizations, and the IAI staff. It was a great pleasure to have served the IAI and its 19 member countries and we wish the IAI much success in its future undertakings.

Gustavo V. Necco
IAI Director
(July – December 2004)

John W.B. Stewart
Interim IAI Director
(January – June 2005)

Cattle Ranching, Land Use, and Deforestation in Brazil, Ecuador, and Peru

Charles H. Wood
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A key dimension of global environmental change is the high rate of deforestation taking place in the lowland tropics of South America as landholders convert primary and secondary forests into pastures for raising cattle. In addition, ranchers often use unsustainable pasture technologies that result in pasture degradation, which in turn compels ranchers to clear additional forest to maintain their herd. Given this relationship between cattle ranching and deforestation, it is likely that studies of factors that motivate farmers to become ranchers as well as their subsequent pasture management choices can be useful in mitigating the environmental damage.

In the Brazilian Amazon, the expansion of cattle ranching among farmers and ranchers of both large and small spreads is occurring at such a rapid pace that concerned analysts have coined the term *pecuarização* (cattlelization). The expansion of cattle ranching is also underway in Peru and Ecuador, but at a slower pace and in response to quite different social and economic incentives and national development policies.

Distinct circumstances in each of the three countries called for a comparative research design rather than the more common focus on a single country or region**.** The IAI's commitment to multinational collaboration provided the rare opportunity to perform such a comparative analysis. In Peru, the focus was on the Alto Huallaga (selva *alta*) and Aguaytia-San Alejandro (*selva baja*) regions. In Ecuador, the study dealt with the Valle de Quijos (*selva alta*), the Puyo-Santa Clara–Palora (*piedemonte*) area, and the Coca-Francisco de

Orelanna (*selva baja*) region. In Brazil, the analysis concentrated on the Eastern, Central, and Western regions, each of which displays more or less distinct characteristics.

Cattle ranching on Amazon floodplain with restinga profile, credit cattle photos to Nigel Smith

Deforestation on such a grand scale is associated with a wide range of variables. History, politics, and demography are implicated, as are monetary exchange rates, inflation, legal institutions, road construction, colonization schemes, tax laws, financial markets, commodity prices, and tenure security, to name the more notable issues cited in recent studies. The environmental context is also relevant because soil quality, water availability, altitude, and temperature range, as well as the presence of pests and pathogens, can affect the way socioeconomic forces work in any given location. It was clear that any study of deforestation would necessarily involve a complex web of interrelationships at different organizational scales and over a range of timescales.

The project required not only an appreciation of the complexity of the causal relationships, but also the ability to develop interdisciplinary research strategies. We used data collection and analysis to help determine the socio-economic and biophysical factors that influence three critical decisions rural landholders routinely make: (1) the decision to invest in cattle; (2) the choice of pasture management technologies by those who raise cattle; and (3) the decision to clear primary or secondary forest for additional pasture. By placing these three decisions at the center of a multi-leveled conceptual framework, we created a research design that showed how local decisions were influenced by events that took place at the regional, national, and international levels.

Another analytical task focused on the stages linking the birth of a calf to the final consumption of beef. Links in the cattle-marketing chain are defined by specific activities, such as the purchase, transport, fattening, and slaughter of animals. Each activity involves a set of more or less distinct social actors whose decisions, like those of ranchers, are conditioned by local/regional, national, and global considerations. Marketing issues proved important because they help

determine the prices ranchers can expect, as well as the quality standards they are required to meet.

Research Strategy

Interdisciplinary teams of experienced field researchers from the United States, Brazil, Peru, Ecuador, and Canada conducted in-depth interviews with land managers. Rather than using a formal questionnaire to survey hundreds of randomly selected respondents, the research teams carried out in-depth interviews with a small number of systematically chosen individuals whose knowledge was relevant to the project.

Cattle degraded TF pasture nr Vila Socorro Mun STM PA 9-1-93

The teams typically included three to six members representing a wide range of specializations, including animal science, veterinary medicine, farming systems, economics, sociology, anthropology, geography, and political science. Findings from the five research sites, as well as comparative analyses of the regional studies, helped us draw conclusions about factors operating at local, national, and international levels that drive the expansion of cattle ranching and that influence the choice of pasture-management technologies.

Socio-Economic Components

Landholders in most regions invest in cattle ranching largely because there are greater economic and practical advantages than with other options. Even if cattle are never marketed, meat and milk make significant contributions to the rancher's household economy. Cattle have other intrinsic commercial advantages. Depending on the character of regional marketing chains, ranchers can choose when to sell their herd — unlike the seasonal sale of perishable

crops. Further advantages include the relative stability of beef prices over time and comparatively fewer labor requirements. In many areas, the expansion of marketing chains linked to regional and national markets has increased the amount that buyers will pay for agricultural commodities. At the same time, these marketing chains have also increased the ranchers' cost of production by upgrading the quality standards applied to beef and dairy products. We also determined that, culturally, ranching is seen as a desirable livelihood.

Cattle milking on small farm nr km 80 Altamira-Itaituba 7-13

Pasture Management

While deforestation was evident in all of the research sites, the factors that led to deforestation varied from one area to another and with the type of producer. The choice of pasture-management strategies depended on the internal characteristics of rural households, on price and market structures, and on the historical and cultural characteristics of the population. The *seringeiros* (rubber tappers) in Acre, whose livelihoods are traditionally tied to the extraction of rubber and harvesting of *castanha* (brazilnuts) and who live within community-governed extractive reserves, were fundamentally different from large ranchers in southern Pará, who exploit vast areas of natural pastures, rely on hired labor, and readily adopt the latest technology to raise and market hundreds, even thousands, of animals. The study found similarly specific characteristics among the different producers and institutional contexts in Ecuador and Peru.

Unsustainable pasture-management practices increase deforestation when ranchers abandon degraded lands and expand into forested areas. Landholders find it rational to adopt extensive rather than intensive pasture management technologies in frontier areas where land is abundant and the cost of additional clearing is low. However, as frontier economies become consolidated and are linked to regional, state, and national markets, the land

values rise. In addition, the incentive to adopt intensive forms of management is often blocked by the lack of either capital or skills to properly care for pastures.

Finding Solutions

In Latin America, Brazil is a leader in the development of pasture-management technologies, many of which are within the reach of poor small landholders. Existing Brazilian expertise can be readily adapted to other locations. Funding initiatives that would disseminate successful technologies from Brazil to Ecuador and Peru is a cheap and effective way to improve land management in the region.

Cattle Nelore in degraded pasture nr Paragominas PA 1991, credit cattle photos to Nigel Smith

In some areas, cattle ranching may actually reduce deforestation. This counter-intuitive conclusion emerged from interviews with small landholders in the Peruvian Amazon who once cultivated coca. Coca depletes soil fertility and public programs to eradicate its production (often promoted with U.S. assistance) have left large areas unsuitable for the cultivation of perennial crops. The incentives designed to benefit former coca producers encourage perennial crop production, but landholders then are likely to deforest new areas where soil fertility is higher. A policy change that includes cattle ranching among the incentives offered by the coca eradication program could help reduce pressure on the forests.

The IAI-funded project generated seven book-length monographs, including an edited volume on land use and deforestation in the Amazon, a monograph on each of the five research sites, and an edited volume that synthesized and compared the results of the regional monographs. Another six books, twenty-four articles, and twelve presentations were prompted by the IAI project.

By involving interdisciplinary research teams, the study promoted close interaction between individuals from a variety of scientific disciplines, cultural backgrounds, and institutional affiliations. The strategy of placing Brazilian researchers in Peru and Ecuador, and the reverse, helped build networks among communities of researchers who rarely have contact with one another. The participants in the IAI-promoted network have continued to work together and have submitted proposals to fund related interdisciplinary projects. Since the project began, the network has used IAI funding to leverage additional resources totaling $2,070,000.

Training sessions were conducted throughout the project. Participants attended annual meetings to discuss methodology and choose fieldwork sites. Workshops helped promote interdisciplinary strategies for collecting and interpreting information obtained from in-depth interviews with key informants.

calves w kids Arapixuna nr Santarém PA 7-22-96, credit photo to Nigel Smith-Cattle

The IAI project has also made a significant contribution to the future by including young scholars in the fieldwork and providing them modest research awards to carry out independent analyses of relevant topics. Direct or in-kind support played a part in twenty academic degrees — benefiting students at various levels. Five students completed a Ph.D. and nine advanced to become Ph.D. candidates; four completed an M.S. degree and two completed a B.S. degree. Those who received partial support from the IAI project represented a variety of disciplines, including anthropology, ecology, economics, sociology, geography, agrarian science, agroforestry, political science, and agronomy.

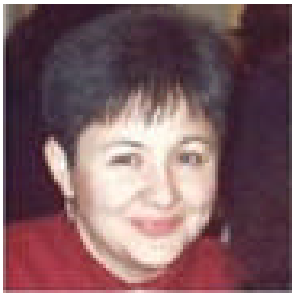
This project to study cattle ranching and deforestation in Brazil, Peru, and Ecuador is one example of IAI's broader contribution to global change research. The IAI's commitment to building future capabilities significantly enhanced the training and international exposure of students and professionals in all three countries. In addition, the IAI's commitment to multinational collaboration promoted a network of researchers who have successfully developed and funded additional projects, often with ties to other international

organizations such as the Center for International Forestry Research (CIFOR), the Large-Scale Biosphere-Atmosphere Experiment in Amazonia (LBA), and the European Union.

Cattle Amazon várzea Parana Cachoeira nr Oriximina 6-20-94, credit photo to Nigel Smi

Through its support of interdisciplinary and comparative research methods, the IAI has furthered our understanding of the causes of environmentally significant land-use decisions. The study's findings are important as nations develop public policies designed to slow deforestation and promote sustainable pasture management in the Andean and Brazilian Amazon.

UMESAM: An Improved Way to Study Mobile Emissions in South-American Megacities



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In 1950, the only city in South America with a population over 5 million inhabitants was Buenos Aires. By the year 2000, six cities on the continent exceeded that number: Bogotá (7 million), Buenos Aires (12 million), Lima (7 million), Rio de Janeiro (11 million), Santiago (6 million), and Sao Paulo (18 million), together representing 75% of the continent's population (http://www.un.org/esa/population/unpop.htm).

Such rapid change has brought new challenges in terms of natural resources, space, and transport management as well as water and air pollution. The deteriorating air quality in megacities has received increasing attention from local decision makers and scientists. Until recently, however, the efforts developed by the local communities have been largely unconnected to those undertaken at the regional scale and even more isolated from those at the global scale.

In early 2004, The IAI helped establish the new Urban Mobile Emissions in South American Megacities (UMESAM) project, a multidisciplinary network of scientists from six countries in the Americas. The thirteen researchers and seven graduate students from Argentina, Brazil, Columbia, Peru, and the United States formed a collaboration of mathematicians, chemists, atmospheric scientists, and climate modelers whose work has led to the development of up-to–date, statistical forward and inverse models of emissions.

The UMESAM also helped forge a link between local air-quality management initiatives and both regional and global Earth System Modeling research. A unique and coherent database has been built to gather and share the model-based emissions inventories as well as the *in situ* measurements of pollutant levels in the megacities from the five South American countries. The webpage built by UMESAM participants makes readily available all the emissions inventories as well as the models and statistical tools used to derive them.

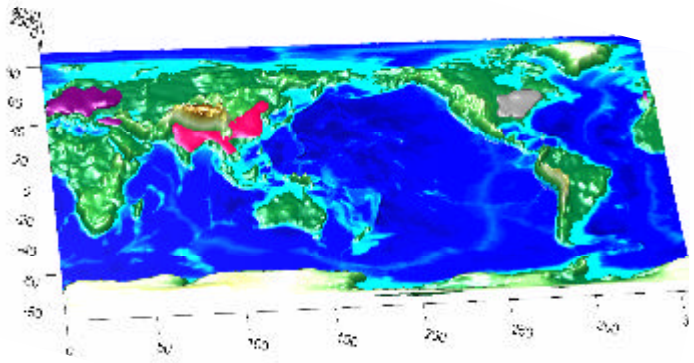
Studying the Problem

To properly quantify air-pollution levels, pollutant-sources, and the trends in air quality, it is necessary to establish regional-scale, long-term measurement networks. Recently, governments have been readjusting air-quality attainment goals by switching from short-term air-quality standards for dealing with acute impacts to long-term air-quality standards that deal with accumulative impacts. Because similar challenges face all megacities in the Americas, decision-makers have looked for cooperative efforts (like those reflected in the Clean Air Initiative for Latin American cities) as an effective way to sponsor cost-effective investigation and policy making (see for example, http://www.worldbank.org/wbi/airelimpio/). In the scientific community, researchers studying global air composition and the interactions between air quality and climate have emphasized the role of megacities emissions in the world's changing atmospheric composition and climate. For example, it has been shown that road traffic is responsible for over 80% of the total source of CO and NOx in South American megacities (see http://www.issrc.org and the references cited there).

Current emissions of several greenhouse gases (CO_2 and CH_4), smog precursors (CO, NO_x, and HC), and particles (PM10) have been assessed at a high spatial (1x1-km or 4x4-km) and temporal (hourly) resolution by employing state-of–the-art tools, including *in situ* measurements of emissions factors,

traffic activity, and pollutant concentrations as well as vehicle emissions models and local and regional air-quality models. Emission inventories have been derived using bottom-up approaches for Bogotá, Buenos Aires, Lima, Sao Paulo, and Santiago. Inverse modeling techniques were used to assess the uncertainties concerning carbon monoxide (CO) emissions.

Global



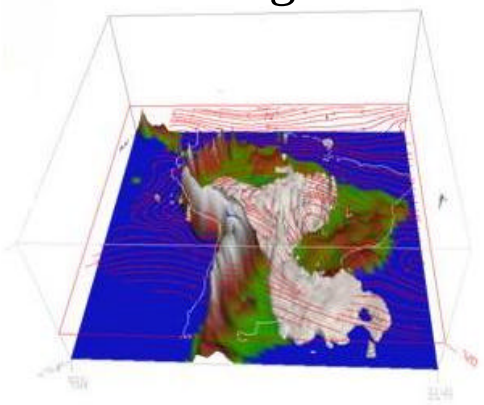
Implementation of a Common Emission-Inventory Methodology

Several South American countries have collaborated to use sophisticated vehicle emissions models that estimate emissions by considering local fuel specifications, vehicle types, emission standards, inspection and maintenance programs, and driving behavior. The UMESAM project provided the framework for implementing and refining the International Vehicle Emissions (IVE) model. The IVE model relies on effective data-collection methods UMESAM employed during extensive field campaigns. Both traffic activity measurements (Phase I) and emission factors measurements (Phase II) can be carried out with equipment readily available in any developing countries that already supports transportation modeling.

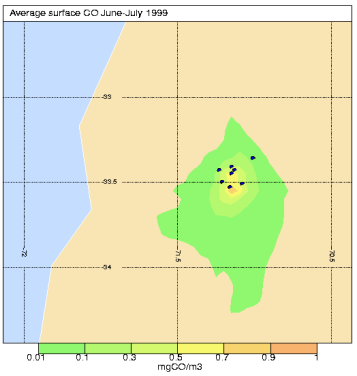
A significant part of the UMESAM effort was focused on adapting the IVE model to correctly reflect specific emissions characteristics from individual South American megacities — such as local on-road technology distributions, driving and start patterns, and fuels. The IVE model relies on effective data collection methods during extensive field campaigns. Both traffic activity measurements (Phase I) and emission factors measurements (Phase II) can be carried out with equipment readily available in all developing countries already supporting transportation modeling. Instead of using existing, static databases, the IVE model estimates emissions of various air pollutants based on the driving patterns and technology distributions measured in specific locations as well as the dynamic behavior of an identified vehicle fleet.

To date, the IVE methodology for traffic activity has been applied in a number of megacities around the world: Los Angeles, United States (three months in 2001); Santiago, Chile (December 2001 and November 2002); Nairobi, Kenya (March 2002); Pune, India (March 2003); Almaty, Kazakhstan (May 2003); Lima, Peru (December 2003); Mexico City, Mexico (January 2004); São Paulo, Brazil (April 2004); Beijing and Shanghai, China (May-June 2004); and Bogotá, Colombia (January 2005). The second phase of the IVE methodology began with fieldwork campaigns in Mexico City (November 2004) and São Paulo (December 2004), and Nairobi (March 2005). All the data from the various campaigns, as well as the IVE software itself, are available from the IVE website (http://www.issrc.org).

Regional



Local



Mobile sources of CO, derived from the IVE or similar emissions models, are available for Buenos Aries, Sao Paulo, Santiago, Bogota, and Lima. The emissions inventories for Santiago and Sao Paulo have been used as input in local air-quality models, and simulated CO concentrations have been compared with *in situ* measurements. By studying discrepancies between the simulated and the observed concentrations, it is possible to further improve the accuracy of emissions inventories. This is the second aspect of the UMESAM project: the inverse modeling of sources.

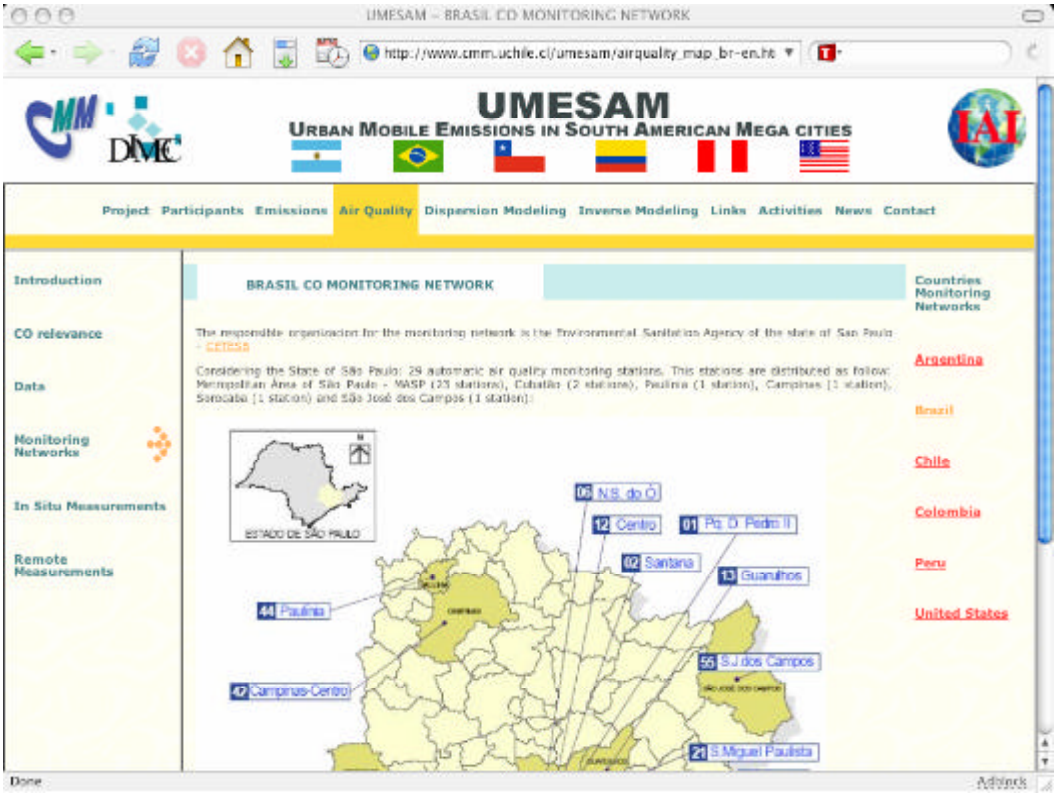
Inverse Modeling Techniques for Source-Estimates

Inverse modeling techniques combine information gained from measurements of pollutant concentrations with information from local or regional models to reduce uncertainties in emission estimates. These techniques are becoming key tools in global-change science, especially in atmospheric science, in part because there are more in situ and remote sensing data available and because local and regional models are more able to reproduce the transport and chemical evolution of pollution plumes.

The UMESAM employed three inverse modeling techniques to assess emissions of CO from mobile sources in Santiago de Chile; the studies used available observations as well as pseudo observations as constraints. The implemented methods were the Best Unbiased Linear Estimator (BLUE), Adjoint, and Sentineles. The study's focus was to test the methods' performances rather than to improve the official inventories. Overall, the tests showed that BLUE, which is a weighted least square method, was computationally inexpensive and a useful technique for improving the available emission inventories — in particular, the emission strength and temporal variations. In addition, this methodology is already applicable in all South American megacities where transport models are available.

Web Page and Database Developments

One of the major achievements of this project was the successful integration of dispersed information about the state of both emission inventories and air-quality measurements in the participating countries. Summaries of the available data and links to the responsible organizations are available on the UMESAM website (http://www.cmm.uchile.cl/umesam). Presentations and tutorials from the UMESAM workshops, as well as practical exercises on inverse modeling, can all be downloaded. The website provides an overall description of the emission inventories and air quality for each megacity as well as information about both direct and inverse modeling in general.



UMESAM's Contributions and the Future

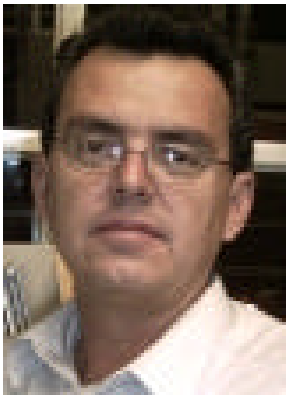
To the best of our knowledge, UMESAM was the first coordinated effort to gather information about air quality and emission data for multiple South American megacities. The fact that this information is now in one database and is accessible through the internet (http://www.cmm.uchile.cl/umesam) is welcome news to many individuals and institutions, particularly those related to the Earth System Science Partnership. For instance, the newly re-established IGBP/Global Emissions Inventory Activity (GEIA) now has a link to the UMESAM webpage (see http://www.geiacenter.org/coordination/links.html).

In addition to important data gathering and methodological developments, UMESAM has promoted tighter connections and increased collaborative efforts among the participating researchers — even stimulating some ambitious new research projects. Furthermore, the project has provided a unique platform for training students in all five South American countries: seven graduate and undergraduate theses have been partially or completely developed in connection with the UMESAM project.

The UMESAM multinational network and the quality and relevance of its scientific results concretely demonstrate that collaboration and scientific exchange in the Americas and beyond are productive pathways for consolidating Earth System Modeling tools, providing a better basis for atmospheric chemistry and climate research, and establishing long-term, sustainable policies in this area of the world.

The 2004 Global Environmental Change Institute on Globalization and Food Systems

Karen O'Brien
Department of Sociology and Human Geography, University of Oslo



Edgar E. Gutierrez-Espeleta
Director of the Statistics Department, University of Costa Rica (former director of the Development Observatory)

How does globalization interact with global environmental change to influence food systems and food security? Who is most vulnerable to these processes of change, and what can be done to mitigate their problems? What are the links between science and policy, and how can they be strengthened?

These are some of the questions addressed at the 2004 Global Environmental Change Institute on Globalization and Food Systems, which was held in Costa Rica from October 24 through November 6, 2004. Twenty-five participants from 22 countries in Latin America, Africa, Asia, and Eastern Europe attended the Institute, which included both a Scientific Workshop and a Science-Policy Forum.

The Institute was organized by the International Human Dimensions Program on Global Environment Change (IHDP) and IAI, in collaboration with partners in Costa Rica, and was hosted by the Mesoamerican Center for Sustainable Development of the Dry Tropics (CEMEDE). The CEMEDE is an academic program at the Universidad Nacional de Costa Rica; its mission is to generate information about the communities, regions, and nations located in the Mesoamerican Dry Tropics

The Institute addressed two research areas of high priority for both CEMEDE and the international community: food security and the management of socio-environmental risk and vulnerability. In fact, one goal of the Institute was to explore critical interactions between global environmental change and globalization and to consider implications for food security, particularly in areas characterised either by poverty and food insecurity or by growing per capita incomes and rapidly changing demands for food. This theme was considered

relevant and important to both science and policy because global environmental change (GEC) and globalization are two of the most transformative processes taking place in the world today.

Scientific Workshop, Field Trip
Oct 24 – Nov 4, 2004
Nicoya, Costa Rica

Another goal of the Institute was to encourage the systematic promotion of young scientists — particularly social scientists — from developing countries and countries in transition and to initiate their future integration into the IAI and IHDP communities by encouraging research on themes highlighted by the workshop.

The Institute also sought to develop partnerships among governments, industries, and communities; to connect local and regional professionals and institutions worldwide with related initiatives and networks; and to inform local and regional professionals about the funding opportunities available to support projects dealing with GEC and food systems.

The Institute included both a Scientific Workshop and a Science-Policy Forum, which was hosted by the Development Observatory (OdD) of the University of Costa Rica (UCR); the National Environmental Forum (NEF) of the National Center of Advanced Technology (CENAT-Costa Rica), and the National Academy of Sciences of Costa Rica (NAS), with the collaboration of the Inter-American Institute for Cooperation on Agriculture (IICA) and the Regional Committee of Hydraulic Resources (CRRH) / Central American Integration System (SICA). The Forum focused on interactions between the scientific community and the policy- and decision-making communities. The intention was to present and discuss scientific information with policy and decision makers from public, private sector, nongovernment organizations (NGOs), etc., who need it for their day-to-day planning processes. The Forum also covered topics such as the usefulness of science for the benefit of societies, ways to present scientific information so that it can be understood and used by the users' communities, and pressing issues that the scientific community needs to address, as seen by the policy and decision makers.

Scientific Workshop,
Field Trip
Oct 24 – Nov 4, 2004
Nicoya, Costa Rica

Global Environmental Change, Globalization, and Food Systems

It is becoming increasingly clear that GEC such as climate change, ozone depletion, land-use changes, and biodiversity loss are influencing both natural and human systems in ways that are unprecedented in recent human history. Environmental changes are not new; however, the rate and magnitude of these changes are expected to challenge both the coping and adaptive capacities of these systems now and in the future. Although the impacts will be widespread, food systems in particular are likely to undergo dramatic changes. The GEC are tightly linked to human activities, being driven by a variety of economic, social, cultural, and political factors. Human contributions to the process of GEC are not equal across nations and among social groups; some entities contribute more to GEC than others. Perhaps more important, the impacts of GEC are not evenly distributed. Some regions, economic sectors, social groups and ecosystems are likely to be more affected than others, in part because their ability to respond and adapt to changes is more limited. Issues of vulnerability and equity have emerged as important cross-cutting issues in human dimensions of GEC research

Environmental change is not the only process that is occurring on a global scale. Globalization — often described as an economic, cultural, and political integration across nations — is also creating rapid and dramatic economic, social, cultural, political, and environmental changes. Advances in biotechnology, transportation, and communication, coupled with the expansion of neoliberal policies of trade liberalization, privatization, decentralization, and increased foreign direct investment are changing global food systems. The consequences are seen in food production and consumption, as well as in the accessibility and availability of food. Like those of GEC, the impacts of these changes are unevenly felt. Although globalization creates many potential benefits and opportunities, it also creates negative outcomes for some regions and social groups. Vulnerability and equity are thus emerging as critical issues in debates about globalization and food security.

Scientific Workshop,
Field Trip
Oct 24 – Nov 4, 2004
Nicoya, Costa Rica

It is important to emphasize that these two simultaneous processes of change — GEC and globalization — are not occurring in isolation. Instead, there are important intersections and interactions at all levels of analysis. The processes, outcomes, and responses are all linked in both direct and indirect ways. Some examples: the increased trade of food contributes directly to greenhouse gas emissions; trade liberalization indirectly influences the ability of some farmers to adapt to changing environmental conditions by destroying markets for traditional crops that were adapted to high climate variability. Changing trade patterns also create new pressures on land, as is the case with soybean production and deforestation in the Amazon. Climate change and increasing scarcity of water in some regions similarly influence the farmers' ability to respond to the demands of a global food market, particularly in the production of water-intensive export crops. Land degradation limits the options for adapting agriculture to a changing global context.

If we are to understand GEC, including vulnerability and equity issues, it is becoming increasingly clear that research programs must consider environmental changes within the dynamic context of globalization. Policies that address or respond to one process of change alone are likely to be ineffective and, in some cases, may contradict policies that address another process. If sustainable development of food systems and livelihoods is the goal, then GEC and globalization must be considered together in relation to both science and policy.

Scientific Workshop

During the Workshop, the Institute's theme of interactions between GEC and globalization was discussed in relation to four of the core science projects under IHDP: Industrial Transformation, Land Use and Cover Change, Global Environmental Change and Human Security, and Institutional Dimensions of Global Environmental Change. The theme was also considered in relation to a joint international project on Global Environmental Change and Food Systems,

as well as to research carried out by leading international institutions such as the International Food Policy Research Institute and International Institute for Applied Systems Analysis. Invited speakers discussed some key issues, including sustainability and diversity; water use; decentralization; changes in biomass linked to transformations in food consumption; changing land use patterns in response to new climate patterns; differential vulnerability to both climate change and trade liberalization; and matters related to the fit, interplay, and scale of institutions.

Scientific Workshop,
Field Trip
Oct 24 – Nov 4, 2004
Nicoya, Costa Rica

Following lectures and group discussions, the participants identified areas of potential research and then worked in small groups — or in some cases individually — to develop project proposals that could evolve into funded research projects. Two examples of the projects that were proposed for the Latin America region are an assessment of the feasibility of small-scale reforestation in existing livestock production systems in Brazil and Uruguay under the Clean Development Mechanism and a study of the potential of Mexico as a supplier to the European Union market for renewable biomass energy.

Participants in the Scientific Workshop considered how and where science can inform or influence policy. Some questioned who the decision-makers and stakeholders are (and what is the difference) and what motivates decisions. One important point made throughout the workshop was that decisions are made at all levels, from the farmer to the president, and thus there may be many points at which scientific results could influence policy.

Institute participants traveled to San Jose at the end of their two weeks to take part in a Science-Policy Forum that was organized as part of the Institute. Bringing a keen interest in the ways science can contribute to or inform policies, participants used the opportunity to listen to the concerns of policy makers and to discuss how they can be addressed by scientific research. Although they acknowledge that “science for the sake of science” can be useful, most of the workshop participants hoped that their research can contribute significantly to

positive changes in the production, consumption, access, and availability of food in the context of both GEC and globalization.

Scientific Workshop
Oct 24 – Nov 4, 2004
Nicoya, Costa Rica

Science-Policy Forum

The Forum focused on the science-policy interface and the integration of scientific information into the policy and decision-making processes. Participants considered what scientific information is available, what aspects need to be better understood, the translation of scientific information for the nonscientific community, the uses of information, and discussions of policy issues that should be incorporated into the scientific community's agenda. Representatives from governmental agencies, national and international organizations, NGOs, and private companies were invited to attend the Forum to learn about the results of the scientific workshop, contribute to the further training of participants, and discuss the scientific and political aspects of global change and food systems with Institute participants from different countries and regions. The Forum covered such topics as the problems of the Central American food systems from the perspective of GEC and globalization.

One point made clearly during the Forum concerned the wide gap between research and policy, the need to recognize that researchers and policy makers work in very different spheres, and the tendency toward a limited flow of information between the two groups. It was noted that researchers and the policy community tend to form stereotypes of each other. For example, researchers often think that policy makers are too busy to read, that they come to hasty conclusions, that their actions are not based on data, that they mistrust research, or that they have a limited vision. Finally, researchers have the perception that policy makers should draw their conclusions from research; that is, researchers should send policy makers technical reports and let them make decisions based on that information.

On the other hand, what do policy makers think of researchers? They think researchers study subjects that are not very relevant to agricultural and livestock policy, that they are not concerned about the repercussions research may have on politics (or that they tend to let themselves be carried away by methodological fashions), that they use too much scientific language, that they speak in inconclusive generalities on broad theoretical topics, and that they do not take enough into consideration the problems faced by the normative authorities — quite apart from the fact that researchers always recommend that they need much more time.

Science-Policy Forum
Nov 5, 2004
San Jose, Costa Rica

Researchers and policy makers have different structural roles and different social peers who validate their work, which brings additional attitudes and behaviors to bear during discussions of issues. Setting policies is primarily a political process. Normally, decisions have important consequences for the prestige, power, and expectations of a variety of actors and groups, and thus they will try to influence the process for their own benefit. Researchers and decision makers must understand the specific environments in which they each work.

The Science-Policy Forum created a neutral space for exchange of ideas. Its intention, in addition to identifying the interface characteristics of the two communities, was to present scientific information to decision makers and, in return, convey the needs of policy makers to the scientists. Participants also wanted to identify necessary communication bridges so that policy decisions might be based on scientific evidence and the results of research might be more useful and beneficial for society.

Benefits of the Institute

The Institute on Globalization and Food Systems created a gateway for scholars to participate in international research networks. Several of the speakers, including Alexander Lopez of Costa Rica (director of CEMEDE and local host of the Institute) and Alejandro Leon of Chile, had attended previous

IAI or IHDP workshops and thus could provide motivation and inspiration to the participants. The intense yet informal setting promoted continuous interaction between lecturers and participants and encouraged mentoring relationships. Participants and lecturers with similar interests formed multinational, collaborative networks and have maintained these contacts through email.

The broad spectrum of participants involved in the Institute, including some with considerable policy and practitioner experience, encouraged in-depth discussions. From a research perspective, the Institute provided an opportunity to address an emerging topic in global change research and allowed participants to identify cutting-edge research topics. Many of the Institute's participants presented research results at the 6th Open Meeting of the Human Dimensions Research Community in Bonn, Germany, in October 2005.

The success of the Institute's Scientific Workshop and Science-Policy Forum stresses the IAI's critical role as a facilitator of multinational collaboration in GEC research as well as its significant contributions to the international research community. The Institute was co-organized with IHDP, which strengthened institutional cooperation and enabled both organizations to emphasize their capacity-building components. The Science-Policy Forum, in particular, served as an opportunity to strengthen regional linkages with IICA and other Central American institutions.

The Institute created an excellent venue for promoting international research and understanding of GEC, globalization, and challenges to food systems in the 21st Century. The Institute's impact will be noticed in the years ahead, as participants become increasingly visible and active in the GEC research community.

IAI Science Programs

The First Round of Collaborative Research Network

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) and through no-cost extensions was active until 2006. The CRN program encompasses most of the IAI's 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 program was not only designed to support research, but also to encourage synergistic networks between scientists in the Americas on global-change problems of importance to the region: scientists and scientific institutions working together in an integrated and collaborative fashion. These highly multidisciplinary networks were designed to enable in-depth investigation of a wide range of global environmental-change issues. They have generated significant, high-quality scientific information that can be and has been used by stakeholders and policy- and decision-makers to aid mitigation of and adaptation to harmful environmental changes and their impacts on our societies. The number of scientists and institutions affiliated with the CRN program has increased every year as PIs (principal investigators) and Co-PIs have added new collaborators. Supplemental and/or parallel funds raised by CRN PIs have also continued to grow; they now exceed US$ 16 million. The major contributors of additional funds were national science and technology organizations of IAI member countries. other institutions providing funds for CRN projects included the European Union, France, Germany, the United Nations Development Program, the Global Environmental Facility, the World Bank, and the Red Latino Americana de Botánica. More than 600 students have benefited from participating in CRN research. 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.

Several of the research projects in the program investigated terrestrial ecosystems and their use.

CRN 001 **Biogeochemical Cycles Under Land Use Change in the Semiarid Americas** (PI: Holm Tiessen) has generated data on land and soil degradation and on resource management options to improve land quality; the project

included researchers from the University of Saskatchewan and partners in Argentina, Brazil, Mexico and Venezuela.

Research on organic matter, nutrient cycling, and erosion was combined to solve a paradox involving 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 137Cs that had labeled the earth's surface evenly during the 1960 hydrogen bomb tests to calculate topsoil 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 topsoil. 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 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 northeastern Brazil, work on water and nutrient cycling in on-farm trials has shown the positive impact of both agroforestry and including succulents (forage cactus) in cropping systems. This practice has stabilized food and fodder production — thereby improving and stabilizing income. An increased use of native legume trees was also proposed as a result of these studies. The positive impacts of increasing "useful" biodiversity on land management improved water-use efficiency and long-term sustainability. This research is extending beyond the CRN due to European and Brazilian funding.

Isotope studies using 14C dating and natural 13C replacement have shown the much more rapid carbon turnover in tropical compared to temperate soils. In the warm temperate soils of La Pampa province, where soil degradation and long-term sustainability are concerns, several sites under different management and vegetation cover showed very fast carbon turnover, with half-lives of only 10 to 12 years compared to half-lives of 50 to more than100 years in temperate grasslands of North America. This surprising and alarming result indicates the high susceptibility to land degradation in the semiarid regions of La Pampa. Conservation management is of great importance under these conditions, and lessons from the well-studied Great Plains can not be applied without careful adaptation. One troubling result was that soils of one region, which had 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 were also quantified: this work has now been taken over by a CRN II project under different leadership.

In Yucatan, off-farm income opportunities have caused widespread abandonment of traditionally managed, shifting cultivation fields. This process was observed during CRN activities, and social and land-cover changes were documented. As a follow-up to the research, the team developed a social accounting matrix and implemented 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 have become a central concern. These studies have made it clear that many of the land-use changes are driven by alternative economic opportunities, including subsidies, and are unrelated to resource quality. A great dangerous aspect of this process is that land-use decisions (or the lack of conscious decisions) are independent of the needs for resource management or conservation.

CRN 009 **Cattle Ranching, Land Use, and Deforestation in Brazil, Ecuador, and Peru** (PI: Charles Wood) carried out research in rural Ecuador and Peru as well as three rural sites in the Brazilian Amazon. 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 used to clear primary or secondary forest.

The findings showed that deforestation is taking place in all regions, although the pace of land-use change varies between sites. 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. Although deforestation was an outcome common to nearly all of the research sites, the factors that led 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. Cattle 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, this 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 for 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 were associated with the CRN project. Young scholars who participated in the fieldwork were aided by 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.D and 9 Ph.D. candidates, 4 MS degrees, and 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** (PI: Osvaldo Sala) had significant implications for science, conservation, and public policy and management decisions from the local to the global scale. This CRN program explored a number of 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 shed new insights on the relationships between biodiversity and ecosystem functioning. In particular, the focus on ecosystems in temperate South America that have experienced 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 biodiversity (species richness) and net primary productivity are positively correlated, as has been demonstrated in a number of experiments with artificially constructed communities. However, in the Patagonian steppe, this relationship is much more pronounced: changes in diversity result in more dramatic changes in primary production. This difference, is attributed to the fact that these ecosystems are intact and undisturbed, and thus long-term consequences of species interactions and in particular positive species interactions (facilitation) have developed.

Experimental results from the Southern temperate forest have also provided important insights. Research in a forest mosaic has demonstrated a significant relationship between above-ground vascular plant diversity and below-ground soil organisms. The abundance of soil-functional groups appears to be affected by the input and quality of organic matter entering the soil pool, in particular, by 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 below-ground diversity have been difficult to establish, in part because it has been extremely difficult to examine these relationships within intact 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 fundamental ecological relationships and for accurately assessing the importance of biodiversity loss in ecosystems. These results have far-reaching importance because maintenance and preservation of biodiversity is one of the pressing concerns for the global community in the next century — affecting political agendas, governments, and public policy.

The research of CRN-012 has resulted in 2 edited books, 45 scientific articles published or in press, 19 book chapters, and 4 popular-science articles. The research and capacity building activities highlight the importance of biodiversity both as an interdisciplinary science and as an emerging public-policy issue of local and global significance.

CRN 040 **Comparative Studies of Global Change Effects on the Vegetation of Two Tropical Ecosystems: The High Mountain and the Seasonal Savanna** (PI Juan Silva) had four main research components. Scientists and (a total of 27) students from Argentina, Brazil, Colombia, and Venezuela investigated (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.

Water plays a fundamental role in determining the biological diversity and stability of tropical ecosystems and provides 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 the ways in which the latter respond to these changes was investigated in two important ecosystems: mountain forests and the seasonal savannas. The research on the water dynamics in mountain forests and associated grasslands was conducted on Andean slopes in three countries Argentina, Colombia, and Venezuela. The water balance in these three ecosystems was affected by floristic composition (especially of the epiphytic community and the grasslands) and (drastically) by the replacement of forests by different types of grasslands. Resulting changes in water flows were particularly important during heavy rainfall, turning these into catastrophic events.

In the seasonal savannas, the annual fluctuations in soil water content at different depths along physiognomic gradients from woody savannas to open grasslands were related to water flows. The replacement of native savannas, well known for their high biodiversity, by introduced pastures with higher water-use efficiency and greater productivity has deeply affected water circulation in

the system. Particularly relevant was the reduction in soil water recharge and in soil-available water for plant growth.

Water availability was shown to be a determinant of savanna structure and functioning. The ecology of savanna trees, the response of different species and functional groups to water availability — as determined by rainfall, geomorphology, and soil texture — provided an understanding of 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. These relationships are important at the regional-climate scale, given the extent of seasonal savannas in South America, their biodiversity, and the rapid transformation of these ecosystems as a consequence of land-use change.

Differences between functional groups as well as between species — at a level of detail such as germination, seedling growth and survival, and performance in water and carbon flows — showed a complex picture of species-specific responses. This suggests 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.

Both paramos and *Polylepis* (the highest growing tree) forests are experiencing high pressure from land-use change. The diversity of functional attributes (which determines the ecological resilience) found in the different species of *Polylepis* along the latitudinal gradient explained some aspects of their success under different climatic scenarios. The responses of paramo vegetation to environmental gradients and their relations to biodiversity, as well as the behavior of individual species and higher taxa, are important because these communities play an important role in the water flows of high tropical mountains at the basin scale. Three major databases for Venezuela: plants from the paramos, plants from savannas, and rainfall data have been made available on the web through IAI Data and Information Systems (DIS). The multi-scale approach of this CRN — from the landscape to the individual plant — permitted insights into the processes and mechanisms involved in the responses of ecosystems to global change.

In combination, these terrestrial ecosystem projects (CRN 001, CRN 009, and CRN 012) provided a comprehensive evaluation of the interactions between land use, ecosystem function, and ecophysiology under global-change and -climate stress.

Closely linked to the terrestrial ecosystems are inland aquatic systems. This link was explored in CRN 047 **Andean Amazon Rivers Analysis and Management Project** (PI: Michael McClain), which aimed at the scientific understanding of Andean Amazon river ecosystems that is necessary for effective management as a result of progressing development and possible climate change.

Landscape analyses centered on classification of terrestrial and aquatic features of the region, examination of biophysical and cultural controls on the configuration of land cover, and an analysis of socioeconomic drivers of land-use change. Innovative aspects of this work included the identification of the best approach to classified, mixed terrestrial/aquatic pixels in Landsat images improved techniques for distinguishing similar land-cover types in western Amazonian settings, the development of techniques to link land-use change to widely available socioeconomic data, and a focus on aspects of the landscape that potentially influence the quantity and quality of water in the region's rivers.

A second major area of activities involved coordinated discharge and water-quality sampling campaigns across pilot basins in Peru, Ecuador, and Colombia. Sampling was conducted at nearly 150 sampling stations over the 5years of the project, and weekly samples were collected over a multi-year period for a subset of approximately 15 stations distributed across all three pilot basins.

Results showed that Andean Amazon rivers generally enjoy high water quality and intact ecosystems, although degraded water quality and compromised ecosystem integrity were documented both in the vicinity of towns discharging raw sewage to rivers and in areas of intense agriculture. Untreated wastes from towns and poor land management in agricultural areas are the most widespread threats, whereas petroleum development and mining are important in certain regions.

During the 5 years of the project, investigators and students were able 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. Four new methods of landscape analysis were developed in student projects: a technique for predicting the rates and patterns of deforestation from widely available socioeconomic data, an end-member mixing technique to identify and map aquatic habitats using Landsat imagery; a technique to distinguish regionally relevant land-use types from Landsat imagery, and a neural network approach to interpolate between climate stations and to develop regional precipitation maps.

Modeling activities in the study of precipitation and runoff for pilot basins in Ecuador and Peru involved compilations of existing climate and runoff data and parameterization, calibration, and verification of basin-scale models. These models will be useful beyond the life of the project for water-resource planning and for evaluating climate change impacts on existing resources.

More than 200 household surveys yielded information about the ways humans both depend upon and impact river ecosystems: how people use water from rivers and how colonists and indigenous people used riparian areas along rivers. The status of more than 100 river sections was documented and related to nearby threats, such as landuse conflict — mostly in Andean and riparian areas where coca is grown. Government fumigation of these areas also

contributes to degradation. Deforested areas and soil compaction in the Orteguaza and Mocoa basins contributed to the highest yield of suspended solids in the basin, with averages of 435 and 413 ppm, respectively. Discrepancies between actual land cover and best land use pose conflicts in the attempt to prevent primary forest degradation, especially when there is little long-term benefit for activities such as agriculture and cattle ranching.

Facilities and infrastructure originally created for this study continue to support global-change research in Peru, Ecuador, and Colombia, and are supported with funding from the Moore and MacArthur Foundations. The Andean Amazon Research Station in Oxapampa, Peru, is gaining regional recognition as a center of research.

A historical perspective on climate change was provided through the tree-ring analysis conducted along the entire backbone of the Americas by CRN003, **The Assessment of Present, Past, and Future Climate Variability in the Americas From Treeline Environments** (PI: Brian Luckman). The project has demonstrated strong linkages between temperature series in Patagonia and Alaska as well as inverse but statistically significant relationships with coral records from the Central Pacific. Other important results have been the first reconstructions of streamflow from Mexico and Chile; which demonstrate the future potential of tree-ring studies in studies of hydrologic variability and water supply throughout the Americas. In North America, the project was useful for reconstructing glacier mass balances through dendrochronologies and establishing links to the Pacific Decadal Oscillation and ENSO events. Examination of the climatic controls of mass balance through these studies is important for understanding future trajectories for glacier change (i.e., melt and recession) in these regions. This CRN has also reconstructed glacier fluctuations in the Patagonian Andes in Argentina.

Long-term (greater than 3000year) chronologies were established for the southern US, and very detailed information was obtained on climate fluctuations in the region. The climate transition around the year 1400, for instance, was marked by warmer sea-surface temperatures in the Pacific, rainier winters, and cooler summers in California and the Great Basin. The Bristlecone Pine records point towards a history of low-frequency El Niño events.

In Mexico**,** the CRN's major achievement has been the development of a network of Douglas fir chronologies from which well-verified reconstructions of precipitation, drought, and streamflow have been established. The longest chronology in Mexico (Barranco de Amealco), derived from a baldcypress stand in Queretaro, is over a thousand years (969–2004). This chronology exhibits reduced growth during periods of extensive historical droughts — particularly 1100 to 1160, coinciding with the decline of the Toltec empire — and has significant potential for a long precipitation reconstruction. During the project, six winter-spring precipitation reconstructions have been developed; the longest (for Durango) is over 600 years. Water supply is the most important climate-variability-related issue in Mexico, and these reconstructions will be of critical

importance for water management in this drought-prone region. This atmospheric phenomenon has great socioeconomic significance, as it is the primary source of water used for livestock, agriculture, industry, and many other activities. In addition, precipitation and drought reconstructions for Mexico have been used to provide detailed evidence for the causes of historically significant socioeconomic events (such as famines, disease outbreaks, and changing crop yields) that influenced the development, peak, and decline of important pre-Hispanic civilizations that flourished in central Mexico.

In 1999, Cook *et al.* (J. Climate, 12, 1145-1162) produced a spectacular gridded reconstruction of the Palmer Drought Severity Index (PDSI) for the co-terminous United States for each of the last 300 years (see http://www.ncdc.noaa.gov/paleo/pdsi.html ref). New moisture-sensitive tree-ring chronologies for Mexico and western Canada, supported by this CRN, have been a major contribution to the recently published, expanded reconstruction (Cook *et al.*, Science, 306, 1015-1018) of this network, which now includes 286 2.5°-grid squares covering most of North America from the Arctic Ocean in western Canada to southern Mexico.

The CRN's work in the tropics has narrowed the latitudinal gap for dendrochronologies by extending the network toward the equator and by investigating new species in both hemispheres. For the first time, sites in both hemispheres have yielded chronologies and climate reconstructions that extend significantly into the tropics. In addition, dendrochronological studies of semi-arid woodland sites have also been carried out in both hemispheres (mesquite in Mexico, *Prosopis* in Argentina) in association with forest management studies of these species for wood and charcoal production.

Pioneer work by the CRN has developed chronologies of up to 705 years from stunted *Polylepis tarapacana* growing on the slopes of Bolivian volcanoes as high as 4900 m; these are the highest tree-ring study sites in the world. The results, which demonstrate a strong relationship between ring-widths and precipitation, have the potential to provide annually resolved proxy precipitation reconstructions for the region over several hundred years.

Dendrochronological studies have yielded significant information on the relationship between climate and forest disturbances. Tree-mortality episodes during the 20th century have been recognized for *Austrocedrus chilensis* growing along the xeric forest-steppe border in northern Argentinean Patagonia. These regional events of tree mortality are associated with extreme warm-dry climatic conditions occurring either in single or in two consecutive summers. Warmer temperatures in the northern Patagonian Andes since the mid 1970s, caused by changes in the Pacific Decadal Oscillation (PDO) modes, have increased the occurrence of lighting-induced fires. It is crucial to understand the effect of recent climate variations on both physical and biological systems in order to predict correctly the ecosystem's responses to future climatic changes across the Patagonian Andes.

A continent-wide synthesis of results shows coherent relationships between high-latitude climates in both hemispheres and the tropical Pacific over

the last 300 years. These relationships are particularly strong at the interdecadal-to-centennial scale. Reconstructed El Niño sea-surface temperatures from the Central Pacific over the last 300 years are positively correlated with tree-ring records from the southwest United States and Central Chile and are negatively correlated with ringwidths on the Bolivian Altiplano. These relationships indicate that precipitation variability in low latitudes is primarily forced by the tropics. However, significant correlations between reconstructed Patagonian temperature records and mean sea-level pressures in the Southern Ocean indicate that precipitation south of 40°S is mainly influenced by extra tropical forcing. These analyses provide the first examples of many potential large-scale regional and global climate linkages that could be examined using the full database being assembled by the CRN.

Links between critical stressors of global change (enhanced UV-B radiation and temperature), ecosystem effects, and societal vulnerability were established by CRN 026, **Enhanced Ultraviolet-B Radiation in Natural Ecosystems as an Added Perturbation Due to Ozone Depletion** (PI: Maria Vernet). Working on the hypothesis that the response of organisms and systems to UVR varies along gradients, this CRN linked data collection, ecosystem modeling, and socio-economic studies. 25 investigators from 18 institutions in 5 countries evaluated the direct and indirect socio-economics impacts of UV-b radiation.

Several experiments showed that environmental stresses other than UV-B confounded the results. The mechanism of chlorophyll-a production in *Salicornia* plants seemed more affected by the local salinity than by the actual UV-B radiation levels. A flavonoid protection mechanism in *Salicornia* seems to have prevented significant damage to the growth and chlorophyll production mechanisms. Yet, plants excluded from UV were taller and showed a tendency of higher number of internodes and branches than **those exposed to** other treatments.

The Chl-b:Chl-a ratio was increased by UV-B in outdoor mesocosm experiments in Brazil and southern Argentina — indicating a community change favouring green algae. Because changes in phytoplankton biomass were minor in all experiments, even though UV-B enhancement was important, the community structure of phytoplankton is probably more important in ecosystem resistance to this stressor. Cell physiological condition was worse under enhanced UV-B. However, this finding was not reflected in the quantum yield of photochemistry (Fv/Fm), which showed no effect from the treatments at all three sites.

Experiments in freshwater demonstrated for the first time the role of UVR in inducing a vertical avoidance behavior in crustacean zooplankton at the whole-lake scale, as well as its role in inducing the synthesis of mycosporine-glutaminol-glucoside, a new photoprotective compound from freshwaters, with putative photoprotective function.

A mathematical model was built to represent the results and showed some unexpected results caused by indirect trophic effects among bacteria,

phytoplankton, and heterotrophic flagellates. The most remarkable effect was an increase in bacteria and flagellate populations as a result of enhanced UVBR. This effect was similar to that observed in experimental mesocosms and is related to the decrease of predation through direct damage to predators (ciliates) by UVBR.

Synergy or feedback mechanisms between different ecosystem effects on marshes/marine systems, education, tourism, were explored in a model designed with stakeholder participation. The synthesis model indicates for marshes, UV-B on a global scale is not a significant stress relative to potential impacts of sea-level rise. Although changes in the marine sector caused by anthropogenic influences may affect global climate change, marshes are expected to be primarily affected by climate change.

An in-depth exploration of societal responses to climate stressors was provided by 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** (PI: Eduardo Franco†, Allan Lavell). The project, spanning 8 countries (Argentina, Brazil, Ecuador, Mexico, Costa Rica, Colombia, Peru and Florida, USA.), was based within the overall framework of the Latin American Network for the Social Study of Disaster Prevention – (LA RED). Comparative research on changing risk patterns associated with ENSO over the last 35 years and the role of social variables in such changes as well as the explanation of loss and damage was based on the creation of a series of national and regional databases for damaging events associated with ENSO and climatic variability in the 8 countries. The information was provided at a high spatial scale of resolution (municipalities, districts, etc.), which required the construction of a regional internet-based documentation system.

The database (DESINVENTAR), built on all damaging hydro-meteorological events from 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 help develop an understanding of changing temporal, spatial, and semantic patterns of events and the attendant impacts at a social level. Thus the database is an invaluable public-domain source of information for policy makers, researchers and others.

Although most emphasis has been on the physical side of ENSO (and associated hazard disturbances such as excessive rainfall, landslides, drought, disease vectors, etc.), the most important controllable impact on loss levels, risk, and future disaster will be determined by social vulnerability. Society's resilience and capacity for adjustment and adaptation are critical factors. Any consideration of the challenges to 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.

Among the major challenges for implementation of risk management practices related to the Niño and Niña, the following considerations were derived from the CRN's research results:

For Central American countries, for example, the types of hazards associated with ENSO are also common under normal annual patterns of climatic variability, whereas in the north of Peru or north-west Argentina, the ENSO risk patterns are almost unique. Such differences are important for decision making and the structuring of integral risk management practice.

Comparative national research results showed 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 generated a contradiction between the improving 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 were very much dependent on human vulnerability patterns and changes; this means that the hazard side of the equation, which has received far more attention, increasingly assumes a lower predictive power as to loss and damage. This result has important practical implications: there must be a reconciliation between the local nature of risk and the centrally, technocratically, controlled intervention decisions and mechanisms that make popular participation difficult and ignore local rationales and needs.

This project demonstrated the need to consider the Niño in the light of climate variability and change in general and not as an independent and autonomous phenomenon. Rather than a special ENSO risk-management system, an integral risk management system is needed for the country or local area, which takes into account not only ENSO 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.

Project results have been made available to different decision-making sectors through conferences, seminars, and publications or have been incorporated into new projects undertaken by team members in the different countries. Training and educational modules developed will permit more widespread impact through such channels.

A broader link between climate variability and human condition was established by CRN- 038, a **Multi-Objective Study of Climate Variability for Impact Mitigation in the Trade Convergence Climate Complex** (PI: M. Pilar Cornejo R. De Grunauer). The project was suspended in 2002 for administrative reasons, and these results pertain to two years of operation.

CRN-038 was comprised of two groups: one analyzed physical processes and the second determined the human dimensions of climate variability. Results for the Caribbean suggested that interannual variability in the early season (May–June–July) is influenced strongly by anomalies in the sea-

surface temperatures of the tropical North Atlantic; positive anomalies over a narrow latitudinal band (0 to 20° N) were associated with enhanced Caribbean rainfall. The coincidence of this band with the main development region for tropical waves suggests a modification of the wave development by the warmer tropical Atlantic. The strong influence of the tropical North Atlantic wanes in the late season (August–September–October); the equatorial Pacific and equatorial Atlantic become more significant modulators of interannual variability. A significant spatial correlation suggests an influence from the El Niño/La Niña: a warm Pacific is associated with a depressed late season and vice versa. There also seemed to be a robust relationship between late-season Caribbean rainfall and an east-west gradient of sea-surface temperature (SST) connecting the two equatorial oceanic basins. Oppositely signed SST anomalies in the NINO3 region and the central equatorial Atlantic (0 – 15° W, 5° S – 5° N) are well correlated with Caribbean rainfall for this period.

Using 94 daily-rain-gauge stations and empirical orthogonal functions analysis, the study calculated the mean dominant annual cycles in the Central American region. This allowed determination of some important aspects of the cycle, such as the start and end of the rainy season and the mid-summer drought. Some latitudinal variations were found in these variables. The region was dominated by one mean annual cycle that captured 72% of the variance. This cycle involved the latitudinal migration of the ITCZ (the seasonal variation of latent heat flux) and low-level wind and its interaction with local orography. The second important annual cycle explains only the 8% of the variance, principally in stations located over the Caribbean Coast of Honduras, Costa Rica, and Panama. At the interannual scale, the wettest (driest) years in the region were dominated in general by warmer (colder) sea-surface temperature in the tropical Atlantic compared with the eastern tropical Pacific.

Monthly data on rice and maize crops were collected and related to meteorological information on air temperature, precipitation, and relative humidity for seven stations for the period 1970-1999. Based on these data, risk analysis maps were constructed for rice and maize crops in the Guayas-Los Ríos and Manabí provinces as a function of geographical position, excess precipitation in each of the highest months, and zone of the low lands. The foundations were laid out for yield-prediction models, but the work was not carried out.

In Ecuador, the group provided a climate alert system, ACUICLIMA (http://www.cenaim.espol.edu.ec/acuiclim/alerta.htm), which is updated weekly. The system has improved the analysis of data from the oceanographic station “El Pelado” off the coast of Ecuador. Another important result of the Ecuadorian studies is the determination that heat balance occurs on ENSO scales and that the fortnightly component of tides is important in the variability of the depth of the 20°C isotherm, which shows evidence of remote and local forcing. The strong relationship between climate, mainly defined by ocean temperature, and shrimp production is a factor of high economic interest.

Human health risks associated with climate change were examined in CRN 048, **Diagnostics and Prediction of Climate Variability and Human Health Impacts in the Tropical Americas** (PI: Ulisses Confalonieri). This project identified linkages between climate (temperature, rainfall, and humidity), land use/land cover changes, and the seasonal and interannual dynamics of malaria and dengue fever.

Peaks of dengue incidence were detected 2 months after peaks in temperature and sometimes also were coincident with peaks in precipitation and/or humidity. Application of simple linear models and transference function models to a series of dengue data and climatological variables showed that, although the dengue-climate relationship was not linear, it was possible to detect a significant correlation between the disease and some climatic variables, usually with a lag time. With the simple linear models, it was observed that the monthly incidence was related significantly to the incidence from 1 to 3 months before. The transference function models represented the dengue/climate relations very well and it was possible to model the number of cases, as well as the incidence, simultaneously. However, the high variability in the equation of the effects has shown that only one climate variable did not explain the variability in incidence rates.

The analysis of the influence of rainfall on malaria incidence yielded heterogeneous results, as a result of non-climatic factors. There were both positive and negative correlations, with lag periods ranging from 1 to 6 months; the correlations were strongest at a 4-month-time delay. Precipitation occurring in the driest months of the year was the most predictive of malaria in Roraima, Brazil. With a log transformation of the disease incidence data, the ENSO Index became significant. The project concluded that transmission of malaria is a complex ecological system. Among the variables affecting malaria incidence are rainfall, temperature, and humidity — all of which have a major impact in the life cycle of insect vectors. Other variables modify the impact of climate: topography, geomorphology, vegetation, and human interventions contribute to an epidemiological response with different characteristics in time and space.

Overall, the project's results demonstrated linkages between ENSO and malaria in Colombia and provided the basis for the development of a Geographical Information System for studying malaria and climate. In the Caribbean islands and in southern Mexico, a link was shown between dengue epidemiology and climate variability. An ENSO-induced drought reduced malaria transmission in parts of the Brazilian Amazon, but this relationship was modified by social-environmental vulnerability factors. In Venezuela, population dynamics of mosquito vectors of malaria were linked to meteorological variables. When life cycles of vectors were examined in more detail, meteorological/hydrological influences on the breeding sites of mosquito populations were documented for both savanna and forest areas in the Amazon.

A mathematical model and simulation were promising tools for analyzing the entomological, epidemiological, and climatic interactions related to malaria transmission and for determining practical mitigation and human health control

interventions. The scientific results were applied to the design of climate-health early warning systems with the goal of optimizing scarce resources from health systems in developing countries in the Americas. Because researchers in this project were frequently based in governmental health departments, these scientific results were very effectively translated into policies and action that will protect the health of affected populations.

Several CRNs were primarily concerned with climate and climate change. CRN 055, A **Regional Program for the Study of Regional Climate Variability and Changes, Their Prediction and Impact in the MERCOSUR Area** (PI: Mario Nunez),studied the physical processes of extreme events in the MERCOSUR area, principally in the context of the South American Low-Level Jet Field Experiment. Results were fed into models to investigate regional climate variability and changes, and an attempt was made to assess the degree to which stakeholders and population understand these extreme events.

Climate over Brazil showed complex rainfall variability over time and space, which is driven by both global and regional phenomena. At interannual and greater scales, El Niño (ENSO) acts mainly over the northeast, Amazonia, and south Brazil. The Pacific Decadal Oscillation (PO), Antarctic Oscillation (AO), and SST of the Atlantic Ocean appear to be the principal forces at interannual scales of rainfall variability over northeast Brazil, Amazonia, and the South Atlantic Convergence Zone (SACZ). Annual rainfall from 1951 to 2000 showed a positive trend over southern Brazil (+180 to +200 mm/ decade) and a negative trend (-180 to -200 mm/decade) over the extreme northwest of Amazonia and some regions of southeast Brazil.

A global vegetation model was used to calculate 12 biome types under 5 climate parameters. The model, coupled to The Atmospheric General Circulation Model of the Center for Weather Prediction and Climate Studies in Brazil (AGCM-CPTEC) was used to search for multiple equilibrium states between vegetation and climate for current climate conditions. Two stable states were found for tropical South America: one corresponds to the current biome distribution and the other to a situation in which savannas replace tropical forest in the eastern Amazonia and a semi-desert replaces dry shrub land in parts of northeast Brazil. A move from one equilibrium state to another was precipitated by perturbations, such as drought, or by radical changes in the biomes of South America as a result of global warming. Under different climate change scenarios for this century, there is a probability of profound biome changes in South America, which could mean replacement of 30 to 50% of tropical forests in Amazonia by savannas, semi-desert vegetation in northeast Brazil, and southward expansion of the subtropical Atlantic forest.

Within this project, a multinational and interdisciplinary team from Argentina, Brazil, Paraguay, Uruguay, and the United States published more than 40 journal articles or book chapters and organized 4 workshops. Modeling the research results from the project helped researchers produce *regional climate change scenarios* for the Second National Communication on Climate Change of Argentina; a regional climate model has been produced for Uruguay

to develop climate scenarios for the Third National Communication of Uruguay. Most of the scientists collaborating in the CRN have participated in the South America Low-Level Jet Experiment (SALLJEX). As a result of the program, some are now also participating as principal investigators in CLARIS, a Europe – South America cooperative research network supported by the European Commission.

South American climate was linked to oceanic processes in CRN 061, an **International Consortium for the Study of Global and Climate Change in the South Atlantic** (PI: Edmo Campos), which is based on a network of scientists and institutions in Argentina, Brazil, Uruguay and USA.

Basin-scale general circulation and climate studies examined the South Atlantic role on inter-ocean exchanges and global thermohaline circulation, the mechanisms of South Atlantic interannual SST variability, and the variability of southwestern South Atlantic fronts.

The project showed that the migrations of the Brazil – Malvinas Confluence at seasonal time scales pivot from a N-S orientation in winter to a NW-SE orientation in summer — a change caused by the decoupling of the surface layer from the main flow at depth during the austral summer. This finding contrasts with the traditional view of the confluence, which suggested extensive seasonal shifts (of the order of 1000 km) along the continental shelf break of eastern South America. Analysis of ocean color, combined with SST in the Argentine Basin, has considerably refined previous classifications of southwestern South Atlantic biophysical provinces. The uneven distribution of SST data in the pre-satellite era (before 1981) in the South Atlantic can create spurious variability patterns when analyzed with empirical orthogonal functions (EOF) in the space domain. Results based on EOF in the time domain, however, lead to more realistic variability structures, which is particularly important because changes associated with data coverage can be incorrectly associated with climate changes.

Previous knowledge about the southeast South America continental shelf was fragmentary, partly due to the sparse synoptic data coverage across political boundaries. The analysis of *in-situ* hydrographic, remote sensing, and atmospheric reanalysis data, along with regional numerical models and new data collected during this CRN project, provided a novel view of the three-dimensional water mass distributions and identification of previously undocumented frontal regions. High-resolution regional modeling efforts over the continental shelf, influenced by winds, tides, continental runoff, and deep ocean circulation, have clearly demonstrated the sensitivity of the simulations to wind forces. This result suggests that numerical model outputs must be interpreted with great caution, particularly over the continental shelf.

Based on satellite-derived ocean color, research shows that the continental shelf of the southwest South Atlantic experiences one of the largest increases in primary production in the oceans. This CRN has confirmed the trend and revealed that the growth is limited to the continental shelf off

Patagonia and that it is caused, primarily, by increased chlorophyll during the austral spring and summer. Increased primary production is thought to be a consequence of global change. The decrease in SST over the shelf seems to confirm this hypothesis.

Regional studies evaluated the Plata River impact on the southwestern Atlantic shelf, providing input to shelf modeling work, and thus permitted the evaluation of seasonal and interannual variability of the Shelf breakfront. Interdisciplinary field work, including oceanographic cruises and airborne surveys, were without precedent in Latin America. Training and education activities were directly linked to the research through on-board short courses during the PLATA oceanographic cruises. Four advanced, international short courses, attended by more than 80 students from several IAI member countries, were organized; more than 40 young scientists and graduate students were trained.

CRN 062, **Eastern Pacific Consortium for Research on Global Change** (PI: Timothy Baumgartner), was a collaborative network of research and education centers in Chile, Peru, Ecuador, Colombia, Costa Rica, Mexico, the United States, and Canada. This group's purpose was to evaluate and anticipate the impacts of global change on coastal and oceanic ecosystems as well as their social and economic consequences, including 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. The project was linked to goals of the IGBP (core projects of GLOBEC and PAGES), CLIVAR of the WCRP, and GOSS program of IOC. The principal research activities involved retrospective/ omparative studies to create a knowledge base, modeling diagnostics at basin and regional scales, regional ocean surveys, and coastal monitoring.

The ocean-climate system affects climate over land and, therefore, the functioning of terrestrial ecosystems. This link, and its impacts on agricultural sustainability, was explored by CRN 073**Climate Variability and its impacts in the Mexico, Central America, and Caribbean Region** (PI: Víctor Magaña). Much of the progress in climate prediction systems, which has helped to either reduce the negative impacts of potentially adverse climate or take advantage of probable adequate climate conditions, has been driven by studies on the impacts of El Niño. This CRN aimed to replicate this progress in the Mexico, Central America, and Caribbean region using research by participants from the United States, Mexico, Costa Rica, Colombia, Cuba, and Jamaica. It examined the characteristics of the annual cycle of precipitation and temperature in the region — specifically, the so-called Mid Summer Drought (MSD), a relative minimum of precipitation in the middle of the rainy season (July and August) as characterized by slightly less rain than the other summer months (June and September) in most of Mesoamerica. Farmers in the region have requested information on the intensity of the MSD because it influences the productivity of crops like maize.

The project results provided an improved explanation for 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 through the 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 northeastern Pacific warm pool. These complex interactions have spatial scales that are not well resolved by current general circulation models used to predict seasonal climate anomalies. Such spatial details will be necessary so that decision makers can plan their activities while considering climate information.

This CRN constructed a regional climate model that combines the NCAR CCM3 and the meso-scale model known as MM5 to explore the possibility of reproducing such small-scale features. In addition, an ensemble prediction system was tested to construct the probability density functions that best represent the probabilities of significant anomalies in climate or anomalies exceeding a threshold value in some climatic parameter that results in negative impacts on a socioeconomic sector. Predicting the annual cycle of precipitation by examining the dynamics of the MSD and the Caribbean Low-Level Jet constituted a challenge: data on the warm pools that surround Mesoamerica is scarce.

Effectively using climate information in various societal sectors was not an easy task because of the limited capacity for climate risk management among stakeholders. Consequently, in the final stages of the project, mechanisms were developed to communicate climate information in terms more easily handled by decision makers. This accomplishment constituted an important capacity-building process in the region; several more years are required for stakeholders of the region to understand the value of a seasonal climate forecasts.

Requests from government officials for advice on climate, water, agriculture, and forests have made CRN73 a reference point for studies on climate variability and change. 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 new initiatives such as NOAA's Intra-Americas Seas Program.

The Second Round of Collaborative Research Network Program (CRN II)

Building upon the successes of the first round of IAI CRNs, the program is expected to provide a second major thrust to global change research in the Americas within the framework of the IAI Science Agenda. It is designed to create networks of scientists throughout the region who will synergistically work

on global change problems of importance to the Americas. The individual projects are expected to significantly contribute to the development and strengthening of a regional capacity to deal with global environmental change issues and their socio-economic impacts. The approach will be integrative – involving the natural and social sciences in a collaborative way – and the program seeks to provide sound scientific understanding in support of sustainable development in the region.

The selection of the CRN-II projects involved a multi-stage review process. In phase I, 93 pre-proposals were submitted under CRN-II Call for Proposals, requesting a total of US$ 80.14 million. Following a pre-selection, in phase II, 37 full proposals were received, requesting a total of US$ 33.63 million. Those 37 full-proposals received 108 mail reviews that assessed their disciplinary scientific merit. A review panel meeting was then held from 20 to 22 July 2005 in Sao Jose dos Campos, Brazil, to evaluate and rank the proposals according to their scientific excellence and technical soundness, policy relevance, multinational and multidisciplinary collaboration as well as integration of natural and social science, contribution to capacity building, and appropriateness of the budget and in-kind contributions in accordance with CRN-II General Guidelines. The ranked list of projects as well as specific comments on all proposals were forwarded to the Scientific Advisory Committee (SAC). During a 3-day meeting, the SAC evaluated the 37 full proposals, taking into account mail and panel reviews and additional aspects such as policy relevance; interdisciplinarity (specifically between natural and social sciences); geographic distribution in regard to research location and distribution of participating institutions; commitment to outreach, education, and capacity-building; budget and budget distribution across participating institutions; gender of participants; potential for continuity after CRN-II; and links to other initiatives in the Americas.

The SAC made a funding recommendation to the IAI Executive Council (EC), which approved the recommended package at its 21st meeting in Puerto Vallarta, Mexico, 8-9 September 2005. The IAI Directorate is now working with the proposals under consideration to address (and integrate) comments made by the review panels. The proposals are also being further developed to interlink networks, reassign budgets, address weaknesses in the integration between natural and social sciences. The development of the CRN program also aims to ensure that the policy impact of scientific output is improved and that scientists actively engage in dialogue towards policy development.

The IAI has now initiated a process by which the overall CRN-II program will be strengthened, particularly in the area of policy engagement, networking, and regional capacity building. Part of this process is the development of cooperation between several teams in the La Plata Basin that can combine studies on land-use, climate models, and risk assessment for a broader regional initiative. Two proposals are being promoted for the Caribbean region with a focus on coastal zones, the effects of changes in land-use, and the incidence of hurricanes. Together, they will provide outreach, capacity building, and policy development for a region that had been underrepresented in CRN-I. Other proposals going forward focus on the functioning of ecosystems across

environments and landscapes; links between above- and below-ground biological processes; the definition and manipulation of functional biodiversity; the human and biophysical dimensions of tropical dry forests; megacities, emissions, and climate; tropical cyclones under a warmer climate; risk reduction for agricultural production under economic and climatic impacts; hydrology of high-mountain regions; and global change processes in the South Atlantic. Several of those teams are now cooperating with each other and with the IAI Directorate in the refinement of their proposals. In a key development, the CRN-II programs will build on what was achieved in CRN-I, strengthening training and education through cooperation between the projects and educational activities of the IAI. Also networking and institutional capacity building will receive greater emphasis and the IAI Directorate will take a more active role in those efforts.

Table 1: Projects funded under CRN II

Title	**PI**	**Countries *(PI country in bold)***
Documenting, understanding and projecting changes in the hydrological cycle in the American Cordillera	**Luckman,** Brian	**Canada,** Argentina, Bolivia, Brazil, Chile, Mexico, USA
Tropical cyclones: current characteristics and potential changes under a warmer climate	**De Raga,** Graciela Binimelis	**Mexico,** Costa Rica, Cuba, USA
Paleotempestology of the Caribbean Region: A Multi-proxy, Multi-site Study of the Spatial and Temporal Variability of Caribbean Hurricane Activity	**Liu,** Kam-Biu	**USA,** Canada, Costa Rica, Mexico
An International Consortium for the Study of Oceanic Related Global and Climate Changes in South America (SACC)	**Piola,** Alberto	**Argentina**, Brazil, Chile, Uruguay, USA
From Landscape to Ecosystem: Across-scales Functioning in Changing Environments (LEAF in Change)	**Sarmiento,** Guillermo	**Venezuela,** Argentina, Brazil, Canada, (Germany)
Functional links between aboveground changes and belowground activity with land use in the Americas: Soil biodiversity and food security	**Berbara,** Ricardo Luis Louro	**Brazil**, Bolivia, Canada, Chile, Cuba, Ecuador, Mexico, USA
Functional Biodiversity Effects on Changing Ecosystem Processes and Services and Sustainability: Interdisciplinary Approach	**Diaz,** Sandra Myrna	**Argentina,** Bolivia, Brazil, Costa Rica, USA

Understanding the human, biophysical and political dimensions of tropical primary and secondary dry forests in the Americas	**Sanchez Azofeifa,** Gerardo Arturo	**Canada,** Brazil, Costa Rica, Cuba, Mexico, USA, Venezuela
Land use change in the Rio de la Plata Basin: Linking biophysical and human factors to predict trends, assess impacts, and support viable land-use strategies for the future	**Jobbagy,** Esteban	**Argentina,** Brazil, Paraguay, Uruguay, USA
South American Emissions, Megacities, and Climate (SAEMC)	**Klenner,** Laura Gallardo	**Chile,** Argentina, Brazil, Colombia, Peru, USA
Caribbean Coastal Scenarios	**McClain,** Michael	**USA**, Cuba, Dominican Republic, Jamaica, (Puerto Rico)
Effective Adaptation Strategies and Risk Reduction towards Economic and Climatic Shocks: Lessons from the Coffee Crisis in Mesoamerica	**Castellanos,** Edwin J.	**Guatemala**, Costa Rica, Mexico, USA

Small Grants Program

The second of the IAI Small Grant Program (IAI-SGP II) closed in 2006 and provided an opportunity for collaborative activities in global change research among scientists and institutions of IAI member countries. SGP II was the second step in Phase II of the IAI programmatic development. The first phase of IAI programmatic development envisaged a sequence of events starting with the Start-Up Grants (SG) to allow review of global change issues and planning of future research, followed by the Initial Science Programs (ISP) and ending with the Collaborative Research Networks (CRN). This phase started in 1995 and resulted in the funding of the first set of Collaborative Research Networks in 1999.

Out of the 22 projects under SGP II, 12 resulted in a full proposal under CRN II:SGPII-002 Koch, SGPII-006 Howarth (CRN-PI Martinelli), SGPII-025 Azofeifa, SGPII-030 Lankao, SGPII-053 Holbrook (CRN-PI Franco), SGPII-056 Klenner, SGPII-061Wania, SGPII-062 Gimenez, SGPII-072 Sanchez-Sesma (CRN-PI Biu-Liu), SGPII-074 Prieto (CRN-PI De Raga), SGPII-076 Sanchez, and SGPII-080 McClain.

Of those 12 proposals, 5 have been approved for funding: SGPII-025 Azofeifa, SGPII-056 Klenner, SGPII-072 Sanchez-Sesma (CRN-PI Biu Liu), SGPII-074 Prieto (CRN-PI De Raga), and SGPII-080 McClain.

Considering that the total number of full proposals under CRN II was 36,

of which 12 have been approved for funding, the SGP II projects provide a substantial portion: 33% of the full proposals and 42% of the approved projects.

SGP II also provided an opportunity for small research projects, training workshops, and preparation of technical reports. The research filled gaps in larger (and also non-IAI) projects; for example, the paleo-hurricane projects SGPII-072 and SGPII-074 (feeding into NOAA), the tree-ring project SGPII-058 (feeding into CRN-003, Luckman), and the anchovy/sardine population project SGPII-69 (feeding into CRN-062, Baumgartner).

Added value was achieved under SGP II through several projects that produced results beyond their original objectives or by extending their original scope through additional non-IAI funds; for example, SGPII-006 was able to conduct a second workshop mainly with leveraged funds; SGPII-016 published an essay in SCIENCE and conducted additional analyses; SPGII-026 provided not only data for scientists but also access via the web to all MODIS Ocean products, as well as a tool to query and analyze the data; and SGPII-056 triggered several projects and activities currently under review by other agencies.

Despite the rather modest funding provided to the individual projects, the program has produced remarkable results — not only scientifically, but also through a outcome of relevance to policy/decision makers (SGPII-056, SGPII-062, SGPII-076, SGPII-078, SGPII-080), resource managers (SGPII-026, SGPII-033, SGPII-057), or conservation policy (SGPII-025).

The second phase of IAI programmatic development started with the launch of the first IAI Small Grant Program (SGP) in 2001. SGP II further encouraged the development of research within the framework of the revised IAI Science Agenda and was intended to support research, capacity building, and planning activities that facilitate the development of larger science programs and research networks similar to the IAI Collaborative Research Network Program (CRN). The program did not entail any thematic priority; the SGP announcement was an open call seeking proposals in three categories: Research, Workshop, and Technical Report. More specifically:

- Small research projects dealing with themes under the IAI Science Agenda, specifically applications on topics that have not been the subject of earlier IAI SG, IAI ISP, or IAI CRN grants but have the potential of creating research thrusts that focus on global change issues of regional importance.
- Scientific meetings to facilitate the planning of future collaborative research activities falling within IAI thematic priorities or inter-disciplinary workshops to bring together scientists and decision makers from different countries, disciplines, and sectors for the purpose of integrating existing scientific knowledge
- Technical reports to be distributed by IAI to selected decision and policy makers throughout the Americas.

The total budget available under SGPII was US$ 600.000, with individual grants up to US$ 30.000.

The 88 proposals received by the deadline (18 August 2003) requested a total of US$ 2.512.527. Before the three-step peer review, all proposals were checked by the IAI Directorate for completeness of submitted documentation. Two proposals were disqualified because of incomplete documentation (no main proposal included). The remaining 86 proposals (41 Research, 42 Workshop, 3 Technical Report) proceeded to the review process.

The proposals were evaluated against the following criteria:

- Scientific excellence and technical soundness
- Multinational and multidisciplinary collaboration
- Contribution to capacity building
- Policy relevance of the proposed activity
- Appropriateness of budget request for the proposed activity and in-kind contributions

The proposal review followed the established IAI three-step peer-review process, including mail, panel, and IAI SAC review. For each proposal, at least three mail reviewers were approached, and 194 mail reviews were received. The IAI Directorate continued to approach mail reviewers for responses until the end of the panel review. Proposals with fewer than two or contrasting mail reviews were assigned to at least two panelists for additional evaluation.

Table 2: Projects funded under IAI SGP II

#	PI	PROJECT TITLE	ADDITIONAL COUNTRIES	CATEGORY *
2	Evamaria Koch	Impact of Global Changes on Seagrasses Along the Americas	**USA,** MEX, BRA	Res
6	Robert W. Howarth	Inter-American Nitrogen Network	**USA**, ARG, BRA, CAN, CHI, MEX, VEN	WS
15	Diego Gaiero	Airborne Transport of Aerosols into the South Atlantic Ocean: Assessment of Sources, Horizontal Fluxes, Iron Fertilizing Potential, and Impact on Climate	**ARG**, BRA, USA	Res
16	Ricardo Grau	Effects of Increasing Urbanization and Agricultural Intensification on Land Cover and Carbon Budgets in Subtropical America	**ARG**, DR, USA	Res

25	Arturo Sanchez Azofeifa	Understanding the Ecological, Biophysical, and Human Dimensions of Tropical Dry Forests: A Regional Workshop	**CAN,** CR, CU, MEX, PAN, USA, VEN	TR
26	Osvaldo Ulloa	Coastal Ecosystems of the South American Region (CESAR): An Integrated Satellite Data Management and Distribution System	**CHI,** ARG, BRA, CAN, USA, VEN	Res
30	Patricia Romero Lankao	Can Cities Reduce Global Warming? Urban Development and the Carbon Cycle in Latin America	**MEX**, ARG, CHI	WS
33	Peter F. Sale	Assessing the Resilience and Dynamics of Coral Reef Populations: A Workshop for Targeted Research on Recruitment Dynamics of Mesoamerican Reef Species	**CAN,** MEX, USA	WS
40	Daniel Conde	Food Web Structure in Two Coastal Lagoons of the Southern Atlantic Ocean: A Comparative Study Using Stable Isotopes Ratios	**URU,** BRA, CHI	Res
53	N. Michele Holbrook	Effects of Bamboo on the Diversity, Productivity, and Stability of Amazonian and Atlantic Forests	**USA,** ARG, BRA, COL, PER	WS
56	Laura Gallardo Klenner	Urban Mobile Emissions in South American Megacities (UMESAM)	**CHI,** ARG, BRA, COL, PER, USA	Res
57	Vicente Ricardo Barros	Trends in the Hydrologic Cycle of the Plata Basin: Raising Awareness and New Tools for Water Management	**ARG,** BRA, PAR, USA, URU	TR
58	Fidel A. Roig	Development of Climate-Sensitive Tree-Ring Chronologies of *Araucaria Angustifolia* in Southeastern South America	**ARG,** BRA, CAN	Res
61	Frank Wania	Persistent Toxic-Substance Fate Along Latitudinal and Vertical Gradients in the Americas	**CAN,** BRA, CHI, CR, USA	WS
62	Agustin Gimenez	Improving Climatic Risk Management for Dryland Cropping in Two Regions of South America: A Regional	**URU,** ARG, BOL, BRA, PAR	WS

		Workshop to Prepare a Research Proposal		
66	Armando Trasviña	Initiating an ARGO Program in the Colombian and Mexican Pacific	**MEX,** COL, USA	Res
69	Dimitri Gutierrez Aguilar	Paleo-Reconstruction of Population Dynamics for Anchovy and Sardine off the Peruvian/Northern Chilean Coast Related to Climate Shifts During the Last 200 Years	**PER,** CHI, MEX, USA	Res
72	Jorge Sanchez-Sesma	Evaluation of Paleo-Hurricanes in the Intra-Americas Sea (IAS): A Reconstruction and Analysis Based on Proxy Records	**MEX,** CR, USA	Res
74	Ricardo Prieto	A Reanalysis of Atlantic Basin Tropical Cyclone Database (With an Emphasis on Cuban and Mexican Land-Falling Hurricanes) and an Update of the Estimation of Risk from Extreme Winds, Waves, and Rainfall	**MEX,** CR, CU, USA	Res
76	Roberto Sanchez	The Human Dimensions of Global Environmental Change in Urban Areas of Latin America: A Network Approach	**USA,** ARG, BRA, CU, MEX	WS
78	Pedro Silva Dias	Environmental Changes in South America in the Last 1,000 Years: Atlantic and Pacific Controls and Biogeophysical Effects	**BRA,** ARG, CHI, PER, VEN	TR
80	Michael McClain	Land-Ocean Interactions in the Caribbean: Formulating a Research Agenda to Support Regional Integrated Watershed and Marine Ecosystem Management	**USA,** CR, CU, DR, GUA, JAM, MEX, PAN, VEN	WS

* Res = Research, WS = Workshop, TR = Technical Report

SGPII-002, The Impact of Global Changes on Seagrasses Along the Americas (US$ 29.978), PI: Eva-Maria Koch. **USA**, Mexico, Brazil.

This project focused on identifying changes and knowledge gaps of the consequences of global change on fisheries habitats and seagrass beds.

A website was developed, SeagrassNet, <www.SeagrassNet.org>, which is permanent web-based document containing up-to-date information on the international activities of the SeagrassNet program, including those funded through IAI.

The participation of park guards in SeagrassNet at Abrolhos (Brazil) has resulted in the inclusion of tourist information that highlights the importance of seagrasses as marine habitats; in this way, activities of the SeagrassNet program are communicated to 7,000-8,000 visitors per year. It is expected that this outreach activity will continue, reaching approximately 40,000 people in the next 5 years.

A public lecture was given at the Abrolhos Marine National Park Visitors Center, in Caravelas, Bahia (Brazil) on 10 October 2004. As a result of this project, since summer 2005 seagrasses are a regular topic of public talks presented at the Environmental Protection areas in Recife, Brazil. The team took the initiative to translate its SeagrassNet manual into Spanish to reach a broader audience and to facilitate the work of colleagues in the Americas. SeagrassNet sites have acted as an anchor for the development of a series of other long-term studies of the area's ecology. After sufficient data, including socio-economic data, have been collected, it will be possible to draw firm conclusions about the effects of global change on seagrass systems.

SGPII-006, Inter-American Nitrogen Network (US$ 30.000). PI: Robert Howarth. **USA**, Brazil, Argentina, Mexico, Venezuela, Chile.

The major objective of the project was to conduct a workshop to form an Inter-American Nitrogen Network initiative and to prepare a proposal for submission under the IAI CRN-II call for proposals. Leveraged funds allowed for a second workshop to consolidate the networks by discussing the commonalities and differences of nitrogen dynamics in the different regions. Collaborations at the national and international level have been strengthened as a result. These collaborations are considered of extreme importance for the advancement of science in Brazil. A combined product of the two workshops was a series of 10 articles comparing nitrogen cycling across the nations of the Americas, which will be published as a book and as a special issue of the journal Biogeochemistry.

SGPII-015, Airborne Transport of Aerosols into the South Atlantic Ocean: Assessment of Sources, Horizontal Fluxes, Iron Fertilizing Potential, and Impact on Climate (US$ 30.000). PI: Diego Gaiero. **Argentina**, USA, Brazil.

From the standpoint of remote sensing, this project's estimations of dust fluxes into the South Atlantic Ocean are the first ever attempted in this part of the world (Patagonia, Argentina), and no similar studies exist that can be compared. However, the magnitudes of mass concentrations obtained are in agreement with similar remote sensing studies in the Sahara desert.

To date, Patagonia has not received much attention as an important source of dust in the region: satellites tend to miss the dust events because they are commonly accompanied by abundant cloudiness, particularly in southern Patagonia. Until the beginning of this project, no direct satellite observations of dust activity in this region had been recorded or investigated.

SGPII-016, The Effects of Increasing Urbanization and Agricultural Intensification on Land Cover and Carbon Budgets in Subtropical America (US$ 30.000). PI: Ricardo Grau. **Argentina**, USA, Dominican Republic.

Results of this project show different trends in land cover at the three study sites. In Puerto Rico, forest cover increased by 26% between 1977 and 1991. This expansion has occurred in all life zones, but more rapidly in the municipalities dominated by the montane wet life zone (average annual increase, 2.2%) than in municipalities in the coast and in the dry forest life zones (1.1 to1.4%). In Tucuman, in contrast, montane forests have remained relatively stable since 1972 (showing only a decrease of 1200 ha, a 0.4% change in three decades), but departments in the dry forests have experienced severe deforestation (a reduction of 314,000 ha). The Dominican Republic shows a combination of both patterns. Forest cover in the nine provinces in the montane forests life zones increased by 185,000 ha between 1984 and 2002; whereas forest cover decreased by 19,000 ha in the two provinces in the lowland dry forests live zone.

In the three regions of Puerto Rico, Dominican Republic, and Argentina, the urban population experienced approximately a two-fold increase during the last 20 years, but the rural populations, populations of domestic animals, and area in pastures have all decreased. The deforestation of lowland dry forests is mainly driven by the expansion of modern agriculture (e.g.,rice and soybean crops), whereas traditional small-scale agriculture in the mountains is in decline. The intra-region analysis showed that in each region there was a positive correlation between an increase in urban population at a local level (municipality, department, province) and an increase in forest and woodland cover. In each region, the department, province, or municipality with a large city (specifically, Ponce in Puerto Rico, Santiago in Dominican Republic, and Yerba Buena in Tucuman) had a strong influence on the correlation.

Despite the differences in population density and the degree of economic development among the three regions, some common patterns were noted:

(1) montane humid forests are the less threatened biome (increasing in Puerto Rico and Dominican Republic, and stable in Tucuman);
(2) lowland dry forests are the most threatened environment (extensive deforestation in Tucuman and Dominican Republic, slow recovery in Puerto Rico); and
(3) montane areas near rapidly expanding middle size cities had an increase in forest cover.

Estimates of carbon fluxes have been possible only to a limited extent because important uncertainties in the emissions data in the study regions are not clearly discriminated in the national estimates. However, a general pattern

can be described. Despite the increase in forest cover (Puerto Rico, Dominican Republic), carbon emissions caused by energy consumption greatly exceeded carbon sequestration by forest re-growth. In Puerto Rico, by year 2000, carbon emissions from energy consumption were approximately 10 times greater than carbon sequestration by forests. In Tucuman, the deforestation of dry forest for agriculture contributed between 35 and 45% to the overall emission during the period 1972-2000. In the Dominican Republic, where forest re-growth was more extensive than deforestation, the ecosystems carbon budget had a positive balance (sink). However, carbon sequestration in forests was exceeded 30 to 50% by estimated emissions attributable to human energy consumption during the last two decades.

SGPII-025, Understanding the Ecological, Biophysical, and Human Dimensions of Tropical Dry Forests (US$ 30.000). PI: Arturo Sanchez-Azofeifa. **Canada**, Costa Rica, Venezuela, Mexico, USA, Panama.

The project held a technical workshop on the human and biophysical dimensions of tropical dry forests in Mesoamerica, the Caribbean, and the Atlantic region of South America. A major result of this workshop was the compilation of 10 workshop presentations into a special issue of a peer-reviewed journal (BIOTROPICA), which dealt with the status and conservation of tropical dry forests of the Americas.

The project concluded that understanding of tropical dry forests is fragmented and extremely limited and that currently no coordinated efforts exist to establish a comparative approach that will characterize the composition and structure of primary and secondary forests in the Americas. Furthermore, understanding of the social science component (forces promoting land use and land-cover change) in tropical dry forests is also poorly understood and fragmented. The project stressed that a significant effort is necessary to bring conservation of tropical dry forests to the attention of funding agencies.

SGPII-026, Coastal Ecosystems of the South American Region (CESAR): An Integrated Satellite Data Management and Distribution System (US$ 30.000). PI: Osvaldo Ulloa. **Chile**, Brazil, Argentina, USA, Canada, Venezuela.

The objective of this project (ANTARES) was to develop a set of applications that help integrate the knowledge generated by NASA and the MODIS Instrument Team into resource management and general education programs. The target environments were coastal zone and oceanic environments of the continent of South America and the Caribbean Sea. The objective included developing a simple and accessible tool to distribute satellite data useful for scientists, educators, the general public, resource managers, and policy makers. Specifically, the objective was to minimize the technical knowledge about satellite data formats, specialized remote sensing background, etc., that has traditionally limited the use of satellite data to a small and select group of people. Web portals were established in Argentina, Brazil, Chile, and the USA. The tool also allows the general public to learn about

coastal and ocean resources and about technologies available for studying processes on Earth that operate over large scales.

The ANTARES project has direct relevance to the development of a scientific basis for ecosystem-based management. It provides a regional, continental-scale infrastructure and network of ocean scientists. The intent was to present the tools and information to resource managers and relevant policy makers after the science basis was validated and the prototype web interfaces were tested. This aspect was not possible under this grant because of the complex technical nature of the data and the data delivery mechanism developed over the course of the year.

SGPII-030, Can Cities Reduce Global Warming? Urban Development and the Carbon Cycle in Latin America (US$ 30.000). Patricia Romero Lankao. **Mexico**, Chile, Argentina

Two workshops were organized under this project: one in Mexico City, Mexico, and the other in Santiago, Chile. The main purpose of the first workshop was to support the long-term fulfillment of team's research project by establishing a well-coordinated and strategic network of case studies and by developing common and comparable methodologies and research targets.

The second workshop intended to: (a) present both activities undertaken and research findings of each team working on four case studies: Buenos Aires, Mendoza, Mexico City, and Santiago; (b) organize the drafting of the report to be sent to IAI; and (c) work on the development of the main components of a new research project, "Carbon City-Network: De-Carbonizing Development Pathways in the Americas," which was submitted by the group to IAI.

The main goal of the overall project was to establish a network of Latin American researchers sharing a common approach and methodology, databases, research targets, and research results. This goal was achieved and the group created the basis of a research protocol that was submitted to the IAI under CRN II. The network also extended its scope to the Americas (not only Latin America) by involving US researchers. A workshop report was published and widely distributed, specifically in the ESSP community. A paper was presented at the IHDP Open Conference in October 2005 in Bonn, Germany. Furthermore, a database was created for the four investigated cities.

SGPII-033, Assessing the Resilience and Dynamics of Coral Reef Populations: A Workshop for Targeted Research on Recruitment Dynamics of Mesoamerican Reef Species (US$15.000). PI: Peter Sale. **Canada**, Mexico, USA, Ireland.

The project held a training workshop for individuals actively involved in coral reef environmental assessment and management in the Mesoamerican region (Yucatan coast of México, Belize, Guatemala, and Honduras), providing instructions for monitoring the recruitment of selected fish, corals, and spiny

lobster. The workshop, entitled: "Recruitment Monitoring Workshop - Using dynamics of reef populations in Managing Coral Reef systems," was held at the Centro Ecologico Akumal in Akumal, México, November 29 to December 4, 2004. The 26 participants were from management agencies, environmental NGOs, and academic institutions in the four countries.

The workshop provided a platform for training field teams across the Mesoamerican barrier reef region, enabling them to make assessments of recruitment rates of fish, corals, and lobster in the region as part of their on-going monitoring activities. It also built knowledge in the marine resource management and NGO communities concerning the importance of assessing recruitment dynamics, as well as the value of such data for environmental and fisheries resource management.

SGPII-040, Food Web Structure in Two Coastal Lagoons of the Southern Atlantic Ocean: A Comparative Study Using Stable Isotopes Ratios (US$ 29.739). PI: Daniel Conde; **Uruguay**, Brazil, Chile.

A preliminary analysis of the project's results highlights what appear to be consistent patterns of trophic structure in brackish coastal lagoon ecosystems, but also reveals some interesting differences.

In the context of climate change, it is well recognized that systems such as coastal lagoons are highly vulnerable. Shifts in the freshwater discharge from coastal basins rank amongst the most relevant changes expected to affect coastal systems of the region as a result of climate changes during the next decades. In coastal lagoon ecosystems, the structure and functioning of biological communities are considered to be strongly dependent on hydrologic processes, particularly on the balance between marine intrusions and freshwater input to the system. Increased or decreased freshwater discharge will have significant consequences on several ecological processes; for example, the loading of terrestrially born organic matter or the structure and dynamics of food webs.

Employing stable isotopes to address the structure of the food webs in the investigated lagoons, the study set an important baseline for the trophic structure of representative coastal lagoons of southeastern South America, which will be used to assess the ecological extent of climate change.

SGPII-053, Effects of Bamboo on the Diversity, Productivity, and Stability of Amazonian and Atlantic Forests *(US$ 25.877*). PI: Michele Holbrook. **USA,** Argentina, Colombia, Brazil.

This project consisted of two workshops to study the effects of bamboo on diversity, productivity, and stability of Amazonian and Atlantic forests. The first workshop was held in the state of Missiones, Argentina, in June 2004; the second was in Merida, Venezuela, in April 2005. Participants included park

personnel; graduate and postdoctoral students from Argentina, Brazil, Colombia, Costa Rica, Paraguay, and the United States; individuals from non-profit organizations; local conservationists; and landholders.

The diversity of bamboo in the New World rivals that of Asia, with bamboo-dominated forests occupying more than 180,000 km2 in southwestern Amazon as well as extensive tracts in both the Atlantic lowland and Andean cloud forests. Substantial discussion focused on how bamboo flowering patterns may influence forest dynamics and ecosystem functions because many bamboos species exhibit mass flowering and create huge gaps at one point in time, whereas others die in a wave-like fashion. The workshop participants identified four major research themes in which the intrinsic biology of bamboo intersects with themes relevant to forest biodiversity and global change. For each theme, a motivating question and testable hypotheses were articulated, based on discussions from the varied perspectives given in workshop presentations. This integrated focus, designed to guide further research, represents the major intellectual outcome and finding of these two workshops.

SGPII-056, Urban Mobile Emissions in South American Megacities (UMESAM) (US$ 30.000). PI: Laura Gallardo Klenner. **Chile**, Brazil, Peru, Argentina, Colombia, USA.

This research project was developed around two work packages: (a) a methodology to estimate urban emissions from mobile sources, and (b) inverse modeling techniques on both regional and local (city-by-city) scales.

One of the major achievements of this project was the successful integration of dispersed information regarding the state of emission inventories and air-quality measurements of the participating countries. Summaries of the available data and links to the responsible organizations can be found in the project website (www.cmm.uchile.cl/umesam). All the presentations and tutorials from the workshops, as well as practical exercises of inverse modeling, can be downloaded.

SGPII-057, Trends in the Hydrologic Cycle of the Plata Basin: Raising Awareness and New Tools for Water Management (US$ 30.000). PI: Vicente Barros. **Argentina**, Brazil, Uruguay, Paraguay, USA.

The project prepared a technical report in form of a book in Spanish, ¨Climate Change and Hydrologic Trends in the Plata Basin: New Tools for Water Management,¨.The book's integrated viewpoint provides further indications of the connections between regional trends and global climate warming, a better understanding of how the regional climate scenarios can be interpreted in the context of potential low-frequency variability, and the awareness that use of water resources in the Rio de la Plata basin may have greater vulnerability than suspected. The book provides background and guidelines on how to use new tools to address the water planning issue. It is

focused on the Plata river basin, a region where water resource planning is of extreme relevance for development policies.

SGPII-058, Development of Climate-Sensitive Tree-Ring Chronologies of Araucaria Angustifolia in Southeastern South America (US$ 28.370). PI: Fidel Roig. **Argentina**, Brazil, Canada.

The project developed a tree-ring chronology network in the Brazilian plateau region, a highland portion of the tropics with temperate climate and several tree species that show distinct growth rings. The project's activities collaborated with those of IAI-CRN 003 (PI: Brian Luckman).

The project formed a collaborative research network, composed of scientists of Argentina, Brazil, and Canada, to study tree-ring chronology from Araucaria angustifolia trees growing at 8 different localities in the Brazilian plateau. This project goal was complemented by the establishment of new tree-ring laboratory facilities at the Department of Ecology of the UFRG in Porto Alegre and the expansion of facilities at the tree-ring laboratory at the Department of Forest Sciences of São Paulo University.

The project was conducted to create opportunities, knowledge, and tools to apply tree-ring chronologies for tracing forest-grassland limits in time and space, which is relevant to understanding the dynamics of the mosaics of forest and Campos grassland in southern Brazil. One of the PhD thesis started during this project is specifically related to this topic. Furthermore, the tree-ring chronologies developed constitute the baseline data for applications used in estimating wood production for sustainable management policies of tropical forests, modeling of carbon cycling in tropical biomes, and other ecological inferences (such as age dating, competition, and stand history).

SGPII-061, Persistent Toxic Substance Fate Along Latitudinal and Vertical Gradients in the Americas (US$ 30.000). PI: Frank Wania. **Canada**, Chile, Costa Rica, Brazil, USA.

The objective of the project was to lay the groundwork for the establishment of a new collaborative research network under the IAI CRN II program. A workshop was held, and attendants agreed on a project outline and began drafting a proposal on persistent toxic substance fate along latitudinal and vertical gradients in the Americas. The resulting proposal was among the final 36 CRN II proposals shortlisted. Although highly ranked, it was eventually not recommended for funding because of the limitations in the funds available under CRN II.

SGPII-062, Improving Climatic Risk Management for Dryland Cropping in Two Regions of South America – A Regional Workshop to Prepare a Research Proposal (US$ 24.750). PI: Augustin Gimenez. **Uruguay,** Brazil, Argentina, Paraguay.

The workshop organized under this project defined the structure of a proposal for a CRN program to establish research projects based on the outcomes of several previous and on-going studies in Australia, Asia, and South America. Studies conducted in these regions demonstrate the utility and acceptance of agricultural-systems-simulation models to quantify management options in response to climate information. These demonstration projects constituted a stepping-stone towards a global, well-integrated research and delivery network now known as RES AGRICOLA (Latin for farmer's business). RES AGRICOLA provides a holistic framework for reducing the vulnerability of farming systems to climate risk in both developing and developed countries.

An important feature of the workshop was the attendance of representatives of agricultural stakeholders from the private and public sectors. The workshop also brought together IAI scientists with colleagues funded by the Asia-Pacific Network for Global Change Research (APN) through their program Scientific Capacity Building/Enhancement for Sustainable Development CAPaBLE.

SGPII-066, Initiating an ARGO Program in the Colombian and Mexican Pacific (US$ 30.000). PI: Armando Trasvina. **Mexico,** Canada, Colombia.

The purpose of this project was to learn logistic details necessary for deploying ARGO profilers and to establish a lasting cooperation between the collaborating institutions. With the deployment of the profiler, Colombia became part of the ARGO network. As a result of administrative difficulties, the project has been severely delayed; although the profiler has been deployed (through the Colombian Navy vessel R/V Providencia), no data products can be reported yet. The delivery of data products will begin as soon as data start arriving from the profiler.

A collaboration agreement was signed between CICESE (Mexico) and the Naval School Almirante Padilla (Colombia). This agreement included the transfer of funds and equipment from CICESE to the Naval School in order to continue the experiment beyond the scope of SGP II.

SGPII-069, Paleo-Reconstruction of Population Dynamics of Anchovy and Sardine off the Peruvian/Northern Chilean Coast Related to Climate Shifts during the Last 200 Years (US$ 30.000). PI: Dimitri Gutierrez. **Uruguay,** Brazil, Argentina, Paraguay.

The highly productive upwelling environment off the coast of Peru and Northern Chile sustains one of the world's largest fisheries, which is subject to dramatic changes at interannual-to-decadal timescales. In order to infer decadal- to centennial-scale population variability before the development of the fishery and thus related to environmental conditions alone, researchers conducted high-resolution studies of fish-scale deposition and other sedimentary proxies for the past 250 years in the central Peruvian margin and

compared the data with fish-scale deposition and existing high-resolution records in laminated sediments of Mejillones Bay (Northern Chile) in the same timescale.

The results, corroborated by ongoing diatom assemblage studies, strongly suggest that the current primary and secondary production (e.g., anchovy production) of the northern Humboldt current system (HCS) is unprecedented for the last 250 years, and that a major re-organization of the ecosystem occurred around the mid-nineteenth century, coinciding with the end of the Little Ice Age.

The results indicate that centennial-scale variability composes large part of the population variability and confirm the coupling of Humboldt ecosystem dynamics and resource yields with predominant climatic conditions at a centennial time-scale. This project's efforts contribute to the future development of forecasting models to predict the effects of the current global change scenario in the HCS.

SGPII-072, Evaluation of Paleo-Hurricanes in the Intra-Americas Sea (IAS): A Reconstruction and Analysis Based on Proxy Records (US$ 30.000). PI: Jose Sanchez-Sesma. **Mexico,** USA, Costa Rica.

Four planning meetings were held under this project to develop a plan for the climatic analysis of paleo-hurricanes. High-resolution trace-element analysis of a stalagmite from Australia has shown that patterns in trace-element concentrations can be related to environmental changes at the cave site. The team investigated whether the record of recent tropical cyclone events (previously identified from stable oxygen isotope ratio perturbations in a Central American stalagmite) is also apparent in the trace-element record from the same stalagmite. Identifying a second stalagmite proxy for past storm events would be an important advance toward high-resolution paleotempestology. One current obstacle to the use of speleothem analysis as a tool for high-resolution paleotempestology is a lack of dateable marker horizons, such as the volcanic aerosols used in ice core records. Demonstrating the existence of trace-element or isotopic markers for volcanic eruptions would mark an important advance in the development of this new approach for studying hurricane-climate interactions.

An important result from this work not described in the original proposal is the inferred El Chichon volcanic signature in stalagmite ATM7 (from Belize). If continued work on this record confirms the working hypothesis (that a measurable volcanic ashfall signature can be identified on the basis of trace-element perturbations in speleothem geochemistry), then a new high-resolution dating technique can be developed for Holocene speleothems. Similar time markers developed for ice cores have proved highly valuable as independent age controls for annually laminated proxy archives. Achieving annual age control on stalagmite proxy records of pre-historic tropical cyclones requires some independent time markers, such as volcanic ash horizons. Although investigations of the dataset continue, the data already collected as a result of

this IAI SGPII grant will be instrumental in testing the feasibility of using trace-element data to identify volcanic horizons in spelean calcite.

SGPII-074, A Re-Analysis of Atlantic Basin Tropical Cyclone Database (with an Emphasis on Cuban and Mexican Landfalling Hurricanes) and an Update of the Estimation of Risk from Extreme Winds, Waves, and Rainfall (US$ 30.000). PI: Ricardo Prieto. **Mexico,** Costa Rica, Cuba, USA.

Under this project, raw hurricane observations for Cuba and Mexico were collected at the Mexican Weather Service office in Mexico City and at the Meteorological Institute of Cuba with several objectives: (1) to compile a comprehensive climatological listing of hurricane landfalls for Cuba and Mexico, similar to what has been accomplished for the United States; (2) to obtain meteorological data for hurricane landfalls in Cuba and Mexico for inclusion in a basin-wide re-analysis; and (3) to assess the basin-wide risk of hurricane winds, waves, and rainfall through the use of this revised database.

To reconstruct the windfield a fluid-dynamic model was used, generating the cyclonic winds from information about the position and intensity of historic hurricanes, in a 1º by 1º grid. No data are known that would be comparable to the results. The results obtained during this project are completely new; no similar results for the same historic hurricanes are reported in the literature. Dr. Christopher Landsea from NOAA is currently working on the Atlantic Hurricane Database Re-analysis Project, which is an effort led by the Hurricane Research Division to extend and revise the National Hurricane Center's North Atlantic hurricane database (or HURDAT) Information about this project is available on the following information webpage: http://www.aoml.noaa.gov/hrd/data_sub/re_anal.html

SGPII-076, The Human Dimensions of Global Environmental Change in Urban Areas of Latin America: A Network Approach (US$ 28.000). PI: Roberto Sanchez. **USA,** Mexico, Brazil, Cuba, Argentina.

The main objective of this project was to expand knowledge and understanding of the negative consequences of global environmental change in urban areas of Latin America. The project also sought to create integrated perspectives of those issues to open opportunities for short- and long-term socioeconomic development in the region. The project developed individual studies by four co-PIs on topics illustrating different interactions between urbanization and global environmental change. The results of those studies are significant, providing valuable information on critical elements of global environment change on important urban areas of Latin America. This information is needed to assist local policy makers and stakeholders in the design of policies and programs that will improve current conditions and help prevent future negative consequences of global environmental change. They also create precedents to assist other urban areas in the region that are facing similar problems and are expected to foster the development of new projects on this topic.

SGPII-078, Environmental Changes in South America in the Last 10,000 Years: Atlantic and Pacific Controls and Biogeophysical Effects (US$ 29.000**)** PI: Pedro Silva Dias. **Brazil,** Argentina, Chile, Venezuela.

The technical report resulting from the two workshops held under this project contains an up-to-date description of the current knowledge of the regional climate and its variability, from the interannual to multi-decadal time scales. Ecosystem changes and paleoclimate proxies are explored in depth using both a review of past information and recent data produced by workshop participants and their associates. The technical report provides several suggestions for future research from the observational point of view, interpretation techniques, and modeling.

Several results, not yet distributed to policy/decision makers or end-users, could be of specific relevance to decision makers. Two particular examples:(1) susceptibility of the coastal ecosystems to sea-level change and application for future scenarios, and (2) validation of the climate models used in the IPCC scenarios for global climate change caused by the concentration of greenhouse gases, particularly in terms of the model's ability to reproduce the past climate (the mid-Holocene in this particular case).

SGPII-080, Land-Ocean Interactions in the Caribbean: Formulating a Research Agenda to Support Regional Integrated Watershed and Marine Ecosystem Management (US$ 29.597). PI: Michael McClain. **USA,** Dominican Republic, Jamaica.

This project supported a collaborative process among scientists, resource managers, and policy makers to formulate a research-priority research and capacity-building agenda for the region over the next 5 years. This process was organized around two international workshops that brought together representatives of key national and regional institutions.

The first workshop took place in Santo Domingo, Dominican Republic, in September 2004 and was used to launch the project and delineate key issues and needs on each participating island nation. The second workshop took place in Miami, USA, in January 2005 and served to both close the planning phase of the project and launch the implementation phase. During the period between the workshops, project participants compiled the SGP-II project results into a proposal entitled "Caribbean Coastal Scenarios," submitted to the IAI CRN-II competition, which will examine the integrated impact of global environmental change and land-based activities on coastal ecosystems in the Greater Antilles region of the Caribbean. In the course of developing the CRN project, the group analyzed the current condition of watersheds on each island and the present impacts on coastal ecosystems. They identified and engaged the government agencies responsible for natural resources management across the land-coastal interface and developed a strategy to coordinate project activities with complementary programs in the region. The resulting project will support collaborative research and informed action among investigators and policy

makers from three states that have so far been only peripherally involved in the IAI process: Cuba, Dominican Republic, and Jamaica. Another product of this project is a new web portal that will link to the IAI-DIS and serves as an outlet to share critical data and related information about activities of Caribbean Coastal Scenarios.

Building Scientific Capacity through Training and Education

Introduction

The IAI's Training and Education (T&E) activities are designed to encourage capacity building in the Americas and are developed within and in parallel with the IAI research programs.

The IAI has three major training priorities (1) support for graduate students in the form of fellowships through research programs; (2) support for technical workshops, scientific meetings, and seminars; and (3) development of IAI Training Institutes in interdisciplinary sciences.

All training initiatives are based on the IAI Science Agenda, which addresses urgent global environmental issues relevant to the region. The Institute realizes that its ability to solve such complex problems depends on its commitment to continually broaden and upgrade knowledge about the natural and societal processes influencing global environmental changes (GEC). The program's success also relies on the combined efforts of well-trained, highly motivated scientists in many fields. Therefore, the IAI makes it a priority to identify, educate, and train promising young scientists from its member countries who can eventually assume leadership positions in global-change research.

It becomes increasingly evident that institutions such as IAI must provide training and support to policy and decision makers who deal with environmental issues — encouraging an integrated approach that involves natural and social scientists. The IAI has developed a particularly effective program for organizing interdisciplinary activities that promote collaboration by establishing fora for dialogue and encouraging information exchange that strengthens communication between scientists and policy and decision makers.

Support to Graduate Students

The IAI considers T&E for students a major vehicle for building the next generation of world-class scientists. The diverse T&E programs offered to students at undergraduate, graduate, doctoral, and post-doctorate levels include fellowships, research positions, and support for attending workshops, seminars, and conferences.

In addition to general T&E activities, each IAI research program includes components to encourage the participation of graduate students, whether they are carrying out masters, PhD, or post-doctoral studies or participating in technical training workshops and seminars organized by teams of principal investigators.

The IAI CRN program contributed significantly to training and development of regional human resources and improvement of the capacity to deal with GEC issues and their socio-economic impacts. Capacity building was an integral part of all projects under CRN and opportunities were provided through various mechanisms:

1. training students through participation in (thematic) courses or workshops;
2. scholarships at undergraduate, graduate, PhD, or PDF level — in particular for nationals from Latin American and Caribbean IAI member countries; and
3. research fellowships.

In total, CRN's support helped 619 students and young researchers to complete their degree from 1999 through 2005 (see Table 1).

Most CRN provided a mixture of the three above mechanisms; however, CRN 003 (Luckman) took a different approach. The project trained a large number of students (129), but did not provide any substantial scholarships to individual students — instead placing its emphasis on provision of hands-on training, dendrochronological fieldweeks, or attendance of special courses instead.

CRN promoted 177 workshops in the Americas. The program provided opportunities for 1,954 students and young professionals to participate and present their work in conferences, seminars, workshops, or training courses (Table 2).

Table 1:

CRN Student Support

	PDF	PhD	M.Sci.	Undergrad	Others	Total
CRN-001	0	16	54	25	5	100
CRN-003	3	21	33	50	22	129
CRN-009	0	12	3	3	3	21
CRN-012	2	5	1	0	1	9
CRN-026	0	10	9	6	6	31
CRN-031	0	7	9	0	10	26
CRN-040	0	16	13	0	65	94
CRN-047	0	0	19	14	8	41
CRN-048	1	5	12	12	4	34
CRN-055	1	9	4	10	0	24
CRN-061	0	14	14	16	10	54
CRN-062	0	7	3	0	0	10
CRN-073	1	8	17	20	0	46
TOTAL	8	130	191	156	134	619

Table 2:

CRN Workshops and Student Participation

PROJECT	WORKSHOPS	STUDENTS
CRN-001	36	100
CRN-003	17	318
CRN-009	16	85
CRN-026	8	13
CRN-040	14	207
CRN-047	7	564
CRN-061	12	121
CRN-073	7	131
CRN-031	38	312
CRN-048	11	23
CRN-062	11	80
TOTAL	**177**	**1954**

** Information collected from the CRN Reports*

Training Institutes on Interdisciplinary Sciences

The IAI supports Training Institutes (TI) for scientists and policy and decision makers who are already in the early to middle stages of their careers. Such programs provide opportunities for experienced scientists from both natural and social science backgrounds to collaborate and learn from one another.

These interdisciplinary TI emphasize an exchange of information about the various scientific languages, needs, and methodologies of disciplines that study GEC. Particular attention is given to socio-economic impacts and ways in which nations can gain a better understanding of the complex mechanisms, degrees of change, causes, and consequences — and therefore, plan sound public and private policies to minimize problems and maximize opportunities.

By fostering the development of such new multidisciplinary, multinational teams, the IAI ensures a future generation of professionals who will be engaged in IAI research programs and networks and will lead the integrated science programs in the next decades.

IAI Training Institutes in 2004

The scientific and policy communities have provided a great deal of positive feedback regarding the effectiveness of IAI TI from 1999 to 2003. Therefore, with the support and mandate of the IAI Scientific Advisory Committee (SAC) and the Executive Council (EC), in 2004 the IAI developed two new TI: “Food Systems, Food Security, and Globalization” and “Urbanization in Latin America.” These

activities involved most IAI member countries, particularly small and under-represented countries from the region.

Participants: a total of 40 professionals from 16 countries of the Americas were trained at the IAI Institutes in 2004. Participants were mid-career researchers, stakeholders, and decision makers working in the field of GEC. The Institutes were oriented to experienced professionals and scholars who have conducted studies or been involved in the planning, management, or development of research or policy projects. The Institutes attracted a mix of participants, which encouraged a multidisciplinary and multifunctional perspective as well as an integrated and comprehensive approach.

Language: One Institute was conducted in Spanish and the other in English.

Partner and Co-Sponsor Organizations: The IAI was successful in developing programmatic, institutional, and financial partnerships. A number of national and international organizations worked with the IAI to cooperatively plan and fund the 2004 Institutes: the Mexican National Institute of Ecology (INE), International Human Dimensions Programme (IHDP), Mexico-US Foundation (FUMEC), University of Costa Rica (UCR)/ Development Observatory of Costa Rica, National Academy of Sciences of Costa Rica, National University of Costa Rica (UNCR), National Center for High Technology/National Environmental Forum of Costa Rica, Regional Committee on Water Resources of Central America (CRRH); International Institute for Cooperation on Agriculture (IICA), and United Nations Food and Agriculture Organization (FAO).

IAI Institute on Urbanization and Global Environmental Change in Latin America, September 27 – October 8, 2004, Mexico City, Mexico

This Institute was co-organized with INE, which served as local host and organizer, and with the collaboration of IHDP and FUMEC.

IAI Institute on Urbanization and Global Environmental Change in Latin America, September 27 – October 8, 2004, Mexico City, Mexico

Objective: To provide a better understanding of the interactions between GEC

and urbanization at local, regional, and global scales. The Institute provided a forum in which the participants could gain a comprehensive and integrated perspective through multidisciplinary and innovative conceptual and methodological approaches. It emphasized GEC as both driver and outcome of human (economical, political, cultural, and social) and physical (urban structure, expansion, and land use) processes in urban areas. In this way, urbanization is viewed as both endogenous and exogenous to GEC; the two aspects must be studied as a tightly coupled system.

IAI Institute on Urbanization and Global Environmental Change in Latin America, September 27 – October 8, 2004, Mexico City, Mexico

Coordinator: Dr. Roberto Sanchez Rodriguez, University of California (USA)

Collaborators and Co-Sponsors:

- Mexican National Institute of Ecology (INE)
- International Human Dimensions Programme (IHDP)
- Mexico-US Foundation (FUMEC)

Other collaborators:

- Autonomous University of Mexico (UAM)
- National Autonomous University of Mexico (UNAM)
- United Nations Environmental Program (UNEP)/Regional Office for Latin America and the Caribbean

Participants: 24 individuals from 12 countries (Argentina, Bolivia, Brazil, Costa Rica, Cuba, Dominican Republic, Jamaica, Mexico, Nicaragua, Puerto Rico/USA, Uruguay, and Venezuela).

IAI-IHDP Global Environmental Change Institute on Globalization and Food Systems — Scientific Workshop and Science-Policy Forum, October 25 – November 6, 2004, Nicoya and San Jose, Costa Rica

This Institute was co-organized by the IAI and the IHDP. The National University of Costa Rica and the National Center for High Technology/National Environmental Forum of Costa Rica served as local hosts.

IAI-IHDP Global Environmental Change Institute on Globalization and Food Systems — Scientific Workshop, October 25 – November 6, 2004, Nicoya, Costa Rica

Objective: The Institute focused on the interactions between globalization and GEC processes and their implications for food systems and food security. Worldwide globalization has been a very powerful driving force since the early 1980s — leading to economic, social, institutional, and cultural changes that influence food systems in myriad ways. These changes are transforming food production and storage, transportation and purchase, access to and consumption, as well as quality and safety. In addition, GEC is concurrently altering both the physical and social conditions that underpin terrestrial and marine food systems. The goal of the Institute was to explore the critical interactions between the two systems and to consider the implications for food security availability, particularly in areas characterized either by poverty and food insecurity or by growing per capita incomes and rapidly changing demands for food.

IAI-IHDP Global Environmental Change Institute on Globalization and Food Systems — Scientific Workshop, October 25 – November 6, 2004, Nicoya, Costa Rica

The Scientific Workshop encouraged the systematic promotion of young scientists, particularly social scientists, from developing countries and countries in transition. The program also was designed to help ensure their future integration into the IHDP and IAI communities through research focused on Institute-supported themes. In addition, the workshop fostered partnerships among governments, industries, and communities; connected local and regional professionals and institutions worldwide through related initiatives and networks; and informed local

and regional professionals about funding opportunities available to support GEC and food system projects.

The Science-Policy Forum focused on the science-policy interface and ways to incorporate scientific information into policy and decision-making processes. Participants discussed what scientific information is available, what aspects need to be better understood, translation of scientific information for the nonscientific community, potential uses of technical information, and policy issues that should be incorporated into the scientific community's agenda. Individuals from governmental agencies, national and international organizations, nongovernment organizations (NGO), and private companies learned about the results of the scientific workshop outlined above, contributed to further training exercises, and discussed the scientific and political aspects of GEC and food systems. The forum was attended by about 100 individuals, including a former President of Costa Rica, the current Minister of Science and Technology of Costa Rica, the Director General of IICA, and the Deputy Director General of FAO/Regional Office for Latin America, among others.

IAI-IHDP Global Environmental Change Institute on Globalization and Food Systems, Science-Policy Forum, November 5, 2004, San Jose, Costa Rica

Coordinators:
Dr. Karen O'Brien, Center for International Climate and Environmental Research (CICERO), University of Norway, Norway
Dr. Robin Lubchenko, Rutgers University, USA

Advisor:
Dr. Eduardo Viola, University of Brasilia, Brazil

Collaborators and Co-Sponsors:

- International Human Dimensions Programme (IHDP)
- Asia-Pacific Network (APN)
- International Foundation for Science (IFS)
- Norwegian Council for Science
- National University of Costa Rica (UNCR)
- University of Costa Rica (UCR)/Development Observatory of Costa Rica
- National Center for High Technology/National Environmental Forum of Costa Rica

- National Academy of Sciences of Costa Rica
- Regional Committee on Water Resources of Central America (CRRH)
- International Institute for Cooperation on Agriculture (IICA)
- United Nations Food and Agriculture Organization (FAO)

Participants: 14 individuals from 11 countries in the Americas (Bolivia, Brazil, Costa Rica, Cuba, Honduras, Guatemala, Mexico, Nicaragua, Peru, Uruguay, and Venezuela). In addition, two representatives from FAO participated as observers and were supported by their home organization. Other participants from Africa, Asia, and Eastern Europe attended this activity, which was supported by IHDP, APN, and IFS.

IAI Training Institutes in 2005

In 2005 the IAI developed two new TI: "Training Institute on Vulnerability Associated with Climate Variability and Climate Change in the Americas," held in Asuncion, Paraguay, from October 17 to 28, 2005 (co-organized with the assistance of the National University of Asuncion); and "Training Institute on Climate and Health in the Americas," held in Kingston, Jamaica, from November 7 to 18, 2005 (in collaboration with the University of the West Indies).

Participants: a total of 44 professionals from 17 countries of the Americas were trained at the IAI Institutes in 2005. Participants were mid-career researchers, stakeholders, and decision makers working in the field of GEC.

Language: One Institute was conducted in Spanish and the other in English.

Partner and Co-Sponsor Organizations: As in 2004, the IAI was successful in developing programmatic, institutional, and financial partnerships. The TI were developed in partnership with local organizations (hosts and co-organizers) and counted on the financial and programmatic support from several collaborating institutions. The IAI was able to leverage additional financial resources and important in-kind contributions, which supported the participation of additional Latin American scientists and speakers.

Sponsors of the IAI TI were the US National Science Foundation (NSF), the International Development Research Centre (IDRC) of Canada, The United Nations World Meteorological Organization (WMO), The International Human Dimensions Programme (IHDP) and The Systems for Analysis, Research and Training (START)/Assessments of Impacts and Adaptations to Climate Change in Multiple Regions and Sectors (AIACC).

Other collaborating organizations, which provided important in-kind contributions and programmatic support, were the International Research Institute for Climate Prediction (IRI), the United Nations International Strategy for Disaster Reduction (ISDR), the Global Water System Program (GWSP), the Technical Planning Secretary of the Presidency of the Government of Paraguay, Environment Canada, Health Canada, the Johns Hopkins University, the US NOAA's Office of

Global Programs, the Pan-American Health Organization (PAHO), and the Ministry of Health of Jamaica.

In addition, the National University of Paraguay and the University of the West Indies in Jamaica provided important in-kind contributions as hosts and co-organizers of the IAI TI.

IAI Institute on Vulnerability Associated with Climate Variability and Climate Change in the Americas, October 17 – 28, 2005, Asuncion, Paraguay

This Institute was co-organized with the National University of Asuncion, which served as local host and organizer.

Objective: The central objective of this TI was to help develop and strengthen the local and regional capacity (human resources) to deal with vulnerability associated with climate variability and climate change in the Americas, particularly Latin America.

Background: Climate change and variability is a global threat and is likely to adversely affect natural and human systems and undermine long-term economic development prospects — in particular, the ability of many countries to deal with environmental threats. The Earth's climate has warmed in the 20th Century, precipitation patterns have changed, sea levels have risen, and most non-polar glaciers are retreating. Many sectors in developing countries are already vulnerable to current climate variability and climate change is adding to their vulnerability. Loss of life and damage from extreme climatic events is already a major barrier to development. In this scenario, cooperation among climate experts, natural resource managers, and risk-disaster managers, in addition to policy and decision makers, is needed. They must develop an integrated understanding of the environmental processes taking place and their socioeconomic impacts in order to provide end users and those making decisions with useful information and better tools to deal with these changes and the potential negative impacts.

IAI Institute on Vulnerability Associated with Climate Variability and Climate Change in the Americas, October 17 – 28, 2005, Asuncion, Paraguay

Program: The program included the general topics outlined below:

Module 1: Fundamental concepts

- Importance of studying climate changes (i.e., today's climate variability and tomorrow's climate change) associated with vulnerability of natural and human systems
- Basic scientific aspects of climate changes (e.g., ENSO in the region, a mitigation issue)
- Extreme events from both climatological and impact views
- Basic concepts of modeling climate changes and their association with vulnerability of systems
- Socioeconomic aspects of the impacts of climate changes

Module 2: Potential Applications

- Importance of analyzing vulnerability and adaptation to disasters Evaluation of vulnerability and risk (including social vulnerability and adaptive capacity as part of the process)
- Methods for assessing vulnerability (e.g., indicators)
- Perception and evaluation as part of the risk-reduction process; e.g., early warning systems and their factors
- Application of these concepts and methods in sample case studies using an interdisciplinary approach.

IAI Institute on Vulnerability Associated with Climate Variability and Climate Change in the Americas, October 17 – 28, 2005, Asuncion, Paraguay

Coordinator: Dr. Luis José Mata, ZEF and the IPCC.

Local organizer: Genaro Coronel, National University of Asuncion, the Faculty of Exact and Natural Sciences (FACEN)

Collaborators and Co-Sponsors:

- US National Science Foundation (NSF)
- International Human Dimensions Programme (IHDP)

Other collaborators:

- International Research Institute for Climate Prediction (IRI)

- United Nations International Strategy for Disaster Reduction (ISDR)
- United Nations World Meteorological Organization (WMO)
- Global Water System Program (GWSP)
- Technical Planning Secretary of the Presidency of the Government of Paraguay

Participants: 24 professionals from 15 countries (Argentina, Bolivia, Brazil, Chile, Colombia, Cuba, Dominican Republic, Mexico, Nicaragua, Panama, Paraguay, Peru, USA, Uruguay, and Venezuela).

IAI Training Institute on Climate and Health in the Americas, November 7 – 18, 2005, Kingston, Jamaica

This Institute was co-organized with the West Indies University, which served as local host and organizer.

Objective: The central objective of this TI was to (1) catalyze stronger interactions among academics, stakeholders, and policy and decision-makers from the countries of Latin America and the Caribbean with respect to theories, models, methods, policies, and initiatives to deal with the impacts of climate variability and climate change on human health in the populations of the Americas, particularly Latin America and the Caribbean, and (2) capture the benefits and mitigate negative environmental and socioeconomic impacts.

IAI Training Institute on Climate and Health in the Americas, November 7 – 18, 2005, Kingston, Jamaica

The programmatic objectives of the TI were to provide participants with a theoretical and methodological framework to better understand climate and health-related issues, such as infectious diseases, natural disasters, food and nutrition security, and water resources. It is critically important to strengthen our capacity to understand and assess these adverse health impacts in order to provide better tools for the decision-makers who must develop adaptation strategies to reduce or prevent such impacts. The approach was fundamentally cross-sector and cross-discipline in that the health sector must engage professionals in climate, weather, ecosystems, water resources, agriculture, and various social sciences. The approach also took into account recent advances in understanding the institutional

structures needed to create effective systems for transferring knowledge to action for climate-related issues.

Background: Public health is vulnerable to climate change and variability. Concerns about the adverse impacts of climate change and variability cover a variety of health-related issues: infectious diseases, natural disasters, food and nutrition security, water resources, heat stress, air pollution, and asthma. Another problem is the risk posed by increased UV radiation exposure as a result of stratospheric ozone depletion, which is a climate issue distinct from the enhanced global warming caused by emissions of greenhouse gases.

IAI Training Institute on Climate and Health in the Americas, November 7 – 18, 2005, Kingston, Jamaica

Program: The program included the general topics outlined below:

Module 1: Science

- Importance of studying climate change and variability associated with vulnerability of natural and human systems
- Basic scientific aspects of climate change and variability (e.g., ENSO in the region, mitigation issue)
- Basic scientific aspects of health risks that are sensitive to climate change and variability
- Socioeconomic dimensions of health risks associated with climate change and variability
- Case studies of infectious diseases, natural disasters, and food and nutrition security

Module 2: Applications

- Importance of analyzing vulnerability and adaptation to disasters
- Social vulnerability and adaptive capacity
- Characteristics of early-warning systems
- Communicating with decision makers and policy makers
- Case studies of operational programs

Module 3: Proposal Development

- Guidance on interdisciplinary proposal development

- Networking with climate and health project teams in Latin America and the Caribbean
- IAI Seed Grant Program and other funding opportunities

Coordinators: Dr. Joan Aron (Science Program Coordinator) and Dr. Simon Young (Applications Program Coordinator)

Local organizer: Anthony Chen, The University of the West Indies

Collaborators and Co-Sponsors:
- US National Science Foundation (NSF)
- International Development Research Centre (IDRC) of the Canadian Government
- International Human Dimensions Programme (IHDP)
- United Nations World Meteorological Organization (WMO)
- Systems for Analysis, Research and Training (START)/Assessments of Impacts and Adaptations to Climate Change in Multiple Regions and Sectors (AIACC)

Other collaborators:
- Environment Canada
- Health Canada
- Johns Hopkins University
- NOAA's Office of Global Programs
- Pan-American Health Organization (PAHO)
- Ministry of Health of Jamaica

Participants: 20 professionals from 14 countries (Argentina, Barbados, Bolivia, Brazil, Colombia, Cuba, Dominican Republic, Jamaica, Mexico, Netherlands Antilles, Panama, Peru, Trinidad, Tobago, and Venezuela).

IAI Training Institute on Climate and Health in the Americas, November 7 – 18, 2005, Kingston, Jamaica

The IAI implemented a Training Institute Seed Grant (TISG) Program as an assessment activity of the 2005 Training Institutes. The IAI was able to obtain additional funds from the US NSF to fund the Seed Grants and leveraged additional resources from partner organizations. TISG was launched at the end of the Institutes to further encourage network building and multinational and

multidisciplinary collaboration. Participants were invited to submit proposals outlining concrete plans of how they plan to implement the knowledge and training gained at the TI (through further training courses, small research projects, engagement with policy and stakeholders, etc). Eight groups submitted pre-proposals on the last days of the activity, and a review committee, which evaluated the pre-proposals, decided to encourage all 8 to submit a full proposal in a second phase.

The TISG were an opportunity for participants of the TI to continue to engage with colleagues to strengthen and foster multinational and multidisciplinary collaboration; and to promote further discussions of the initial research ideas originated in Paraguay and Jamaica. They were also an effective impact-assessment mechanism of the TI — evaluating the application of the information, knowledge gained, and its potential use.

Eight proposals were submitted to the IAI in response to TISG opportunity (see tables 3 and 4)

Table 3: Proposals Submitted to the Training Institute Seed Grants on Vulnerability Associated with Climate Variability and Climate Change in the *Americas (Asuncion, Paraguay, 17-28 October, 2005)*

Ref.	Project title	Name of Principal Investigator (PI)	PI's Institution	PI's Country	Other Participating Countries
TISG-P-1	Prácticas Útiles de Adaptación frente a Eventos Hidrometeorologicos asociados al Cambios y la Variabilidad Climática en América Latina y el Caribe	Claudio Szlafsztein	Universidade Federal do Pará, Centro de Geociências	Brazil	Argentina Chile Colombia Cuba Mexico Panama
TISG-P-2	Decision Support System for Risk Reduction in Agriculture, Phase I: ENSO Effects on Soybean Yields in Eastern Paraguay	Norman Breuer	University of Miami, Rosenstiel School of Marine and Atmospheric Sciences	USA/ Paraguay	Bolivia Brazil Dominican Republic Paraguay Peru
TISG-P-3	Evaluación de la Vulnerabilidad actual y futura de los Sistemas Pastoriles frente a la Variabilidad y al Cambio Climático: Caso Uruguay	Gabriela Cruz Brasesco	Universidad de la República, Facultad de Agronomía	Uruguay	Argentina Brazil Mexico Nicaragua Paraguay Peru
TISG-P-4	Evaluación de la Vulnerabilidad agrícola en cacao, banano y papa por Variabilidad y Cambio Climático en los Andes de América	Ramiro Villarpando	Universidad Mayor de San Simón, Facultad de Ciencias Agrícolas y Pecuarias	Bolivia	Paraguay Peru Venezuela

Table 4: Proposals Submitted to the Training Institute Seed Grants on Climate and Health in the Americas *(Kingston, Jamaica 7-18 November, 2005)*

Ref.	Project title	Name of Principal Investigator (PI)	PI Institution	PI Country	Other Participating Countries
TISG-J-1	Evaluación de Eventos Climáticos Extremos y su Impacto en la Salud en América Latina: casos contaminantes atmosféricos y su influencia en enfermedades respiratorias agudas en la zona metropolitana de Guadalajara; y olas de calor y su incidencia en enfermedades cardiovasculares en Buenos Aires	Hermes Ramírez	Universidad de Guadalajara, Instituto de Astronomía y Meteorología	Mexico	Argentina Bolivia Brazil Cuba Panama
TISG-J-2	Evaluación Eco-Regional del Efecto de la Variación Climática sobre la Transmisión de Dengue	Guillermo Rúa	Universidad de Antioquia, Programa de Estudio y Control de Enfermedades Tropicales	Colombia	Bolívia Peru Collaborators: Mario Lamfri, Argentina, and Jose Azoh, Mexico
TISG-J-3	Validación Local de Modelos de Predicción de Enfermedades transmitidas por Vectores y asociadas al Clima	Marilyn Aparicio Effen	Ministerio de Desarrollo Sostenible, Programa Nacional de Cambios Climáticos Docente Investigador IINSAD-UMSA	Bolivia	Argentina Brazil Colombia Dominican Republic Peru The Netherlands Antilles Venezuela
TISG-J-4	A Cross-Cultural Study on Vulnerability to Dengue Transmission in Three Impoverished Urban Communities of Latin America and the Caribbean. Insights on Environmental Risk Factors and Human Behavior	Rubén Aníbal Bejarán	Universidad of Buenos Aires, Departamento de Ciencias de la Atmósfera y los Océanos	Argentina	Colombia Jamaica Mexico Peru The Netherlands Antilles Trinidad and Tobago Voluntary Advisor: Dr Dave Chadee, Trinidad and Tobago

** All Cuban activities were funded by Canada's IDRC and the IAI Director's Special Fund (non-US resources)

All proposals were subject to peer review and were evaluated against the following criteria:

- scientific excellence and technical soundness,
- multinational and multidisciplinary collaboration,
- contribution to capacity building,
- policy relevance of the proposed activity, and
- appropriateness of budget request for the proposed activity and in-kind contributions.

Two review committees (one for TI Paraguay and one for TI Jamaica) were set up to examine the reviews of the proposals and to make a final decision. All proposals were rated fundable (Good and above ratings), based on the following rating scale:

Excellent > 5
Very Good > 4
Good > 3
Fair > 2
Poor > 1

Eight grants have been awarded at the total cost of approximately US$ 100,000; they involve more than 44 researchers from many countries in the Americas, including many from small nations who will participate in an IAI research activity for the first time. Awards will be on a one–time basis at a support level of US$ 10,000 – 15,000 per grant.

In February 2007, the sub-award grantees will be responsible for submitting a final report after completion of the project, describing the results and how the knowledge gained at the Institute was further disseminated and the potential impacts of these activities in capacity building, institutional strengthening, network development, and promotion of the science-policy interface.

We are convinced that despite being a modestly funded program, the TISG is a catalytic mechanism for promoting the development of new collaborative activities among professionals and institutions in the Americas, fostering capacity-building in developing countries, and providing ways to disseminate useful knowledge for our societies.

Initial Assessment and Primary Results of TI in 2004-2005

A written evaluation of the Institutes held in Mexico, Costa Rica, Paraguay, and Jamaica ranked the IAI Training Institute Very Good-Excellent for quality and effectiveness in meeting the goals for which they were designed. All 84 participants acknowledged the high level of presentations by the coordinators and invited guest lecturers and were very impressed with the professionalism, knowledge, and experiences of all the speakers. Furthermore, the participants acknowledged both the uniqueness of this kind of Institute and the professional training provided to participants through such benefits as its (1) multidisciplinary approach for assessing and dealing with the impacts of GEC; (2) combination of diverse

expertise, discipline, and knowledge; (3) science/policy interface and discussions of the usefulness of scientific information in planning policy and decision making; (4) opportunity for networking and exchange of data, information, and experiences; and (5) development of professional and human networks.

The IAI Training Institutes were also successful in achieving their stated objectives of catalyzing exchanges across disciplines and borders concerning research and funding, and furthering present and future collaborations between countries in the Americas, particularly Latin America. This success was a result of excellent institutional partnerships and logistical support, an effective division of labor between complementary coordinators, a series of high-quality invited speakers, a broad complement of activities, and, above all, a strong and diverse group of participants with vision.

Development of Networks

Another positive outcome of these TI was the development of an initial network of scientists and other professionals. Following the Institutes, participants set up an email listserv, which promotes information interchange, collaborative ties, and shared data products between colleagues in several countries. Participants immediately planned future activities, visits, and joint proposals to the IAI and to other science organizations. In addition, the Institute experience has helped not only to shape and strengthen graduate theses and dissertations but also to develop capacity building in NGO — many of which were previously isolated but now benefit from contacts with other research and policy institutions. Moreover, a concrete benefit of the TI is the immergence of 8 research teams that were established as a result of the TISG program and have collaborated in the development of small research activities in the Americas.

Institutional and Financial Partnership Development

The IAI worked with several organizations to organize and fund the four Institutes. Direct financial resources and important in-kind contributions totaled an estimated US$ 200,000 and were leveraged with these organizations. This fact alone shows that other organizations perceive the IAI activities worthy of financial and human investment as well as institutional involvement.

Publications

Two publications already have been produced as a result of the TI in Costa Rica: one describing the Science Workshop (published by IHDP and available in English) and the other addressing the Science-Policy Forum (produced by IAI and IICA and available in both English and Spanish).

Another book, published as a result of the TI on urbanization, will include a summary of the Institute's program and talks, discussions, and set of recommendations, as well as the papers by invited guest speakers; these materials outline the TI's themes and sub-themes and describe participant contributions. The book will be published in both English and Spanish and is expected to be available in 2006-2007. This publication is being co-funded by IAI and UNEP.

The IAI produced a CD-ROM of presentations, discussions, and associated electronic documents for all four TI. All participants, guest speakers, local organizers, and partner organizations have received a copy of the CD. For further information on the IAI TI, please access the Institutes website at www.institutes.iai.int, which contains announcements of opportunity, program descriptions, resumes of selected participants, lists of coordinators and invited guest speakers, and logistical information, as well as lists of reference materials and speakers' presentations.

IAI Support of Other Activities

Various other T&E-based initiatives that contribute to the building of scientific capacity in the Americas are supported by the IAI. Workshops, seminars, conferences, and other venues encourage the exchange of information and data providing scientists and professionals in global change related fields many opportunities to interact and benefit from multinational, multidisciplinary collaborations. Some of the important initiatives supported during the 2004–2006 fiscal years are listed below.

III International Scientific Conference, Large-Scale Biosphere-Atmosphere Experiment in Amazonia (LBA), July 27-29, 2004, Brasilia, Brazil.

Panel on Managing the Commons in an Age of Global Transition: Empowering Fishing Livelihoods and Strengthening Partnerships Between Local Fishers and Scholars in Latin America and the Caribbean (LA&C), August 9-13, 2004, Oaxaca, Mexico.

Workshop on Indexes of Climate Change Detection, August 9-14, 2004, Maceio, Brazil.

Workshop on El Niño Early Warning for Sustainable Development in Pacific Rim Countries and Islands, September 13-16, 2004, Galapagos, Ecuador.

Interdisciplinary Workshop: Antarctic Peninsula Climate Variability: History, Causes, and Impacts, September 16-18, 2004, Cambridge, UK.

VI Seminar on Remote Sensing and Geographic Information Systems Applied to Silviculture, October 5-7, 2004, Curitiba, Brazil.

First SOLAS Science Conference, October 13-16, 2004, Halifax, Canada.

DIALOG VI Symposium, October 30 – November 6, 2004, Dauphin Island Sea Lab, Dauphin Island, Alabama, USA.

The Southern Pacific Universities Network (RUPSUR), Third Meeting on Biophysical and Socioeconomic Impacts of ENSO on Marine and Terrestrial Ecosystems, November 11-12, 2004, Santiago, Chile.

Workshop on Land Management and Sustainability: Working Out Multidisciplinary Strategies for the Development of Dry Lands, November 29-30, 2004, University of San Juan, Argentina.

Research Program, Vulnerability of Soil Organic Matter to Temperature Changes: Exploring Constraints Due to Substrate Decomposability and Microbial Community Structure coordinated by Colorado State University, USA, in collaboration with CENA-USP (Capacity Building Component).

Conference on Emerging Issues Along Urban/Rural Interfaces: Linking Science and Society, March 13-16, 2005, Atlanta, Georgia, USA.

Meeting on Holocene Environmental Catastrophes in South America: From the Lowlands to the Andes, March 13-19, 2005, Mar Chiquita, Cordoba, Argentina.

Summer School on Environmental Modeling of Amazonia, April 10-15, Angra dos Reis, Brazil.

XII Brazilian Symposium on Remote Sensing, April 16-21, Goiania, Brazil.

First International Coordination Workshop for the Establishment of a FEALAC Network for the Exchange of Information on ENSO, April 27-29, Lima, Peru.

Joint Assembly of the American Geophysical Union (AGU), May 23-27, 2005, New Orleans, USA.

Summer Training Course 2005 - Satellite Remote Sensing in Biological Oceanography, June 3-17, Cornell University, Ithaca, New York, USA.

START Visiting Scientist and Fellowship Program, May 19 - June 18, 2005, Madrid, Spain.

Large-Scale Biosphere-Atmosphere Experiment in Amazonia (LBA) - II Congress of Students and Fellowships Recipients (CEB), July 11-13, 2005, Manaus, Brazil.

SOLAS Summer School 2005, August 29 – September 10, 2005, Corsica, France.

Meeting of Education and Scientific Committee of Madre de Dios/Peru, Acre/Brazil, Pando/Bolivia, and Ucayali/Peru (MAP) Inititative, September 9-10, 2005, Cobija, Pando, Bolivia.

Summer School on Integrated Resource Management in the Tropics, September 19-30, 2005, Goettingen, Germany.

Meeting of Education and Scientific Committee of Madre de Dios/Peru, Acre/Brazil, Pando/Bolivia, and Ucayali/Peru (MAP) Inititative, September 23-24, 2005, Cobija, Pando, Bolivia.

Planning Meeting for the Conformation of the Regional Group of Experts on Indexes and Indicators of Climate Change for Western South America, October 5-7, 2005, Guayaquil, Ecuador.

VI Open Meeting of the Human Dimensions of Global Environmental Change Research Community, October 9-13, 2005, Bonn, Germany.

I Regional Conference on Global Change: The South American Case, November 6-10, 2005, São Paulo, Brazil.

First DIVERSITAS International Conference on Biodiversity, Integrating Biodiversity Science for Human Well-Being, November 9-12, 2005, Oaxaca, Mexico.

Workshop Effects of Natural Fluctuations of Marine Coastal Fisheries of Sardines and Anchovies and Their Impact on Fishing-Dependent Human Communities, November 14-17, 2005, Tokyo, Japan.

Meeting of Education and Scientific Committee of the Madre de Dios/Peru, Acre/Brazil, Pando/Bolivia, and Ucayali/Peru (MAP) Inititative, November 17-18, 2005, Puerto Maldonado, Madre de Dios, Peru.

Ecology in an Era of Globalization – Challenges and Opportunities for Environmental Scientists in the Americas, January 8-12, 2006, Merida, Mexico.

Global Biodiversity Forum, March 20-31, 2006, Curitiba, Brazil.

Workshop on Advancements in Modelling Physical-Biological Interactions in the Early-Life History of Fish: Recommended Practices and Future Directions, April 3-5, 2006, Nantes, France.

Symposium on Climate Change: Organizing the Science in the American Cordillera (CONCORD), April 4-6, 2006, Mendoza, Argentina.

IX Session of the CLIVAR VAMOS Panel, April 22-23, 2006, Foz do Iguaçú, Brazil.

VIII International Conference on Southern Hemisphere Meteorology and Oceanography, April 24-28, 2006, Foz do Iguaçú, Brazil.

Satellite Remote Sensing in Biological Oceanography Summer Training Course 2006, June 2-16, 2006, Ithaca, New York, USA.

Members of IAI Institutional Entities

The Conference of the Parties

The **Conference of the Parties** (CoP) comprises representatives from all countries ratifying the Montevideo Agreement and is the Institute's policymaking organ. It establishes, reviews, and updates the Institute's policies and procedures and evaluates its work.

The Executive Council

The **Executive Council** (EC) is made up of nine members, each of whom is elected by the CoP for a two-year term, and has two mandates: (1) to develop policy recommendations for submission to and approval by the CoP, and (2) to ensure that policies adopted by the CoP are implemented by the Directorate.

As prescribed in the agreement that established the IAI (Agreement Establishing the Inter-American Institute for Global Change Research, IAI/Legal Document 1/1992), the IAI institutional entities (CoP, EC, and SAC) meet once or twice a year to discuss and approve important scientific and institutional guidelines and policies related to planning and further development of the IAI's work.

Representatives of the CoP and EC

(An asterisk after the name of a country indicates that it was a member of the EC as well as the CoP for the period 2004-2006).

ARGENTINA*
Carlos Eduardo Ereño, Comisión Nacional para el Cambio Global (CNCG): 2004–2006

BOLIVIA
Oscar Paz Rada, Ministerio de Desarrollo Sostenible y Planificación: 2004–2006

BRAZIL*
Antônio Mac Dowell, Agência Espacial Brasileira (AEB): 2003–2005
Gilberto Câmara Neto, Instituto Nacional de Pesquisas Espaciais (INPE): 2003–2005
Maria Assunção Faus da Silva Dias, Centro de Previsão de Tempo e Estudos Climáticos (CPTEC) Instituto Nacional de Pesquisas Espaciais (INPE): 2005–2006

CANADA*
Marc Denis Everell, Environment Canada: 2004–2006
Bruce Angle, Environment Canada: 2004–2006

Michel Béland, Environment Canada: 2004–2006
Louis Grittani, Environment Canada: 2004–2006

CHILE
Eric Goles Chacc, Comisión Nacional de Investigación Científica y Tecnológica (CONICYT): 2004–2006
Renato Quiñones, Universidad de Concepción: 2004–2006

COLOMBIA
Carlos Costa Posada, Instituto de Hidrología, Meteorología y Estudios Ambientales (IDEAM): 2004–2006

COSTA RICA*
Eladio Zárate, Instituto Meteorológico Nacional (IMN): 2003-2004
Paulo Manso Salgado, Instituto Meteorológico Nacional (IMN): 2004–2006

CUBA*
Bárbara I. Garea Moreda, Ministerio de Ciencia, Tecnología y Medio Ambiente: 2004–2006

DOMINICAN REPUBLIC
Frank Moya Pons, Secretaría de Estado de Medio Ambiente y Recursos Naturales: 2003-2004
Rene Ledesma, Subsecretaría de Gestión Ambiental: 2003-2004
Max Puig, Secretaría de Estado de Medio Ambiente y Recursos Naturales: 2004–2006
Zoila González Gutiérrez, Secretaría de Estado de Medio Ambiente y Recursos Naturales: 2004–2006

ECUADOR
Luis A. Romo Saltos, Secretaría Nacional de Ciencia y Tecnología (SENACYT): 2004–2005
Jose Varea Terán, Fundación para la Ciencia y la Tecnología (FUNCACYT): 2004–2005
Alfredo Valdivieso Gangotena, Fundación para la Ciencia y la Tecnología (FUNCACYT): 2004–2005
Arturo Carpio, Fundación para la Ciencia y la Tecnología (FUNCACYT): 2005–2006
Patricio Yépez, Fundación para la Ciencia y la Tecnología (FUNCACYT): 2005–2006

GUATEMALA
Noe Adalberto Ventura Loyo, Consejo Nacional de Áreas Protegidas: 2004–2005
Hugo Figueroa, Instituto de Meteorología: 2004–2006
Ana Luisa Noguera, Consejo Nacional de Areas Protegidas: 2004–2006

JAMAICA * (2005-May 2006)
Antony Chen, University of West Indies: 2004–2006
Gladstone Taylor, International Centre for Environmental and

Nuclear Sciences, University of West Indies: 2004–2006
Michael Taylor, University of the West Indies: 2004–2006

MEXICO*
Adrián Fernandez Bremauntz, Instituto Nacional de Ecología (INE): 2004–2006
Arnoldo Matus Kramer, Instituto Nacional de Ecología (INE): 2004–2006

PANAMA * (May 2006-present)
Gonzalo Menéndez Franco, Autoridad Nacional del Ambiente (ANAM): 2004–2006
Zoila Aquino, Autoridad Nacional del Ambiente (ANAM), Oficina de Asuntos Internacionales: June 2006-present
Santiago López, Ministerio de Relaciones Exteriores, Departamento de Desarrollo Sostenible de la Dirección General de Organismos y Conferencias Internacionales: June 2006-present

PARAGUAY
Ruben García Giménez, Universidad Nacional de Asunción (UNA): 2004–2006
Genaro Coronel, Universidad Nacional de Asunción (UNA): 2004-2006

PERU
Pablo Lagos, Instituto Geofísico del Perú (IGP): 2004–2006

URUGUAY
Oscar Brum de Mello, Ministerio de Vivienda, Ordenamiento Territorial y Médio Ambiente: 2004–2005
Mariano Arana, Ministerio de Vivienda, Ordenamiento Territorial y Médio Ambiente: 2005-2006
Jaime Igorra, Ministerio de Vivienda, Ordenamiento Territorial y Médio Ambiente: 2005-2006

USA*
Margaret Leinen, National Science Foundation (NSF): 2004–2006
Paul Filmer, National Science Foundation (NSF): 2004–2006
Vanessa Richardson, National Science Foundation (NSF): 2004–2006
Louis B. Brown, National Science Foundation (NSF): 2004–2006

VENEZUELA*
Marlene Yadira Córdova, Ministerio de Ciencia y Tecnología: 2004–2006
Mary Isabel Fernández Briceño, Ministerio de Ciencia y Tecnología: 2004–2005
Tibisay Hung Rico, Ministerio de Ciencia y Tecnología: 2004–2005
Nuris Orihuela, Ministerio de Ciencia y Tecnología: 2005-2006
Gioconda Luna, Ministerio de Ciencia y Tecnología: May 2006-present

EC Bureau (July 2004 to May 2006)
Chair: Adrian Fernandez, Mexico
First Vice-Chair: Michel Béland, Canada
Second Vice-Chair: Bárbara Garea, Cuba

EC Bureau (May 2006-present)
Chair: Maria Assunção Faus da Silva Dias, Brazil
First Vice-Chair: Paulo Manso Salgado, Costa Rica
Second Vice-Chair: Margaret Leinen, USA

Institutional Meetings of the CoP and EC

CoP:	Twelfth meeting: May 5-6, 2005, Montreal, Canada Thirteenth meeting: May 22-24, 2006, Porlamar, Venezuela
EC:	Twentieth meeting: May 2-3, 2005, Montreal, Canada Twenty-first meeting: September 8-9, 2005, Puerto Vallarta, Mexico Twenty-second meeting: May 22-24, 2006, Porlamar, Venezuela

The Scientific Advisory Committee

The **Scientific Advisory Committee** (SAC) is the Institute's main scientific advisory body. Its ten members are elected by the Conference of the Parties (CoP) for three-year terms. A member may serve a maximum of two terms. The SAC makes recommendations to the CoP regarding the Science Agenda, long-term plans, the Institute's annual program, and science programs to be funded. In addition, it assesses the scientific results of the Institute's funded research.

Walter Fernández Rojas	University of Costa Rica: 2000-2006
Area of Expertise	Atmospheric Physics, Climate Change, Applications of Meteorological Satellites, Structure and Dynamics of Clouds and Storms
Luiz Fernando Legey (Co-Chairman)	Federal University of Rio de Janeiro: 2001-2006
Area of Expertise	Human Dimensions, Engineering, Urban and Regional Mathematical Modeling
René Pablo Capote Lopez	Ecology and Systematic Institute: 2001-2006
Area of Expertise	Vegetation, Ecology, Land Use and Cover Change (LUCC), Forestry
Silvia L. Garzoli	National Oceanic and Atmospheric Administration (NOAA): 2002-2006
Area of Expertise	Physical Oceanography, Coastal and Estuarine Processes, Oceanic Circulation and its role in Climate Change

Michael Brklacich (Chairman)	Carleton University: 2002-2006
Area of Expertise	Human Dimensions, Food Systems, Social Vulnerability
Vicente R. Barros	University of Buenos Aires: 2004-2006
Area of Expertise	Climatology, Climate Variability, Climate Change
Rana A. Fine	University of Miami: 2004-2006
Area of Expertise	Physical and Chemical Oceanography
Luis José Mata	Center for Environmental Science (ZEF): 2005-2006
Area of Expertise	Heat Transfer and Fluid Dynamics, Environmental Science, Vulnerability related to Climate Change
Telma Gloria Castro Romero	National Autonomous University of Mexico (UNAM): 2005-2006
Area of Expertise	Physical Sciences, Atmospheric Dynamics and Atmospheric Chemistry
Juan Valdés	University of Arizona: 2006-2006
Area of Expertise	Water Resources Management; Mathematical Models of Natural Resources Systems; Environmental Risk Assessment, Sustainability Science

Chairs of the SAC:
Walter Fernández Rojas, University of Costa Rica: 2004–2005
Michael Brklacich- Carleton University: 2005-2006

Institutional Meetings of the SAC

Twenty-first meeting: November 9-10, 2004, Santiago, Chile
Twenty-second meeting: July 26-28,2005, São José dos Campos, Brazil
Twenty-third meeting: April 19-21, 2006, Toronto, Canada

The IAI Directorate Staff

The Directorate is the Institute's primary administrative organ and comprises a Director, Scientific Officer, Administrative and Financial Officer, Training, Communications and Outreach Officer, Information Technology Manager, Collaborative Research Network Project Manager, and support staff.

Gustavo V. Necco
Director
(until December 2004)

John B.W. Stewart
Interim Director
(January to July 2005)

Holm Tiessen
Director
(August 2005-present)

Gerhard Breulmann
Scientific Officer

Silvio Bianchi
Administrative and Financial Officer

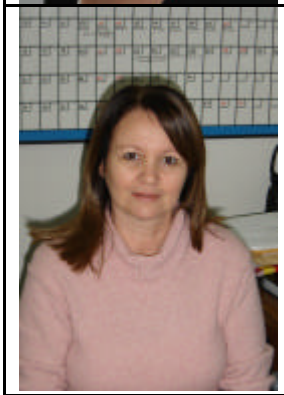
Marcella Ohira
Training, Communications, and Outreach Officer

Luís Marcelo Achite
Information Technology Manager

Eduardo M. Banús
CRN Project Manager
(until December 2004)

Ione Anderson
CRN Project Manater
(July 2005-present)

Raquel Paviotti Corcuera
Visiting Scientist

	**Thelma Krug** Visiting Scientist		**Luciana O.Q. Ribeiro** Executive Assistant to the Director
	**Anita J. Soares** Financial Assistant		**Fábio Henrique S. Pinto** Computer Program
	**Eliana Chaves Pelogia** Temporary Administrative Assistant (August 2005 to February 2006)		**Claudia C. Fernandes** Administrative Assistant
	**Celine Demaret Leite** Administrative Assistant (February 2005-present)		**Isabel C. Vega** Administrative Assistant (until July 2005)
	**Roseli Machado da Silva Luz** Administrative Assistant (August 2005-present)		**José Carlos de Sousa, Jr.** Clerk

	**Antônio Oliveira** Clerk (December 2005-present)	

The IAI Newsletter Staff

	Editor: **Carlos Eduardo Ereño**		Staff: **Paula Richter**

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E-mail: iainews@at.fc

Communication and Outreach Mechanisms

The IAI uses a variety of communication and outreach mechanisms to increase its visibility, disseminate the results of its scientific research and capacity-building efforts, and distribute information about its activities and programs to the scientific and policy-making communities as well as to the general public.

The IAI Newsletter

The IAI Newsletter is a periodical publication that describes the organization's institutional and scientific development activities, including announcements of opportunities, general background on global change, articles about scientific projects, and information about partner organizations and other institutions that are also studying global change issues.

For the period July 2004 – June 2005, the Newsletter's editorial board was composed of Carlos Ereño (editor), Maria Assunção Silva Dias and Alejandro Castellanos (members of the IAI Scientific Advisory Committee), Gustavo Necco (IAI Director), Gerhard Breulmann (IAI Scientific Officer), and Marcella Ohira (IAI Training, Communication, and Outreach Officer).

Two issues of the IAI Newsletter were published during the fiscal year 2004-2005:

Number 35: covering the period May – August 2004
Number 36: covering the period September – December 2004

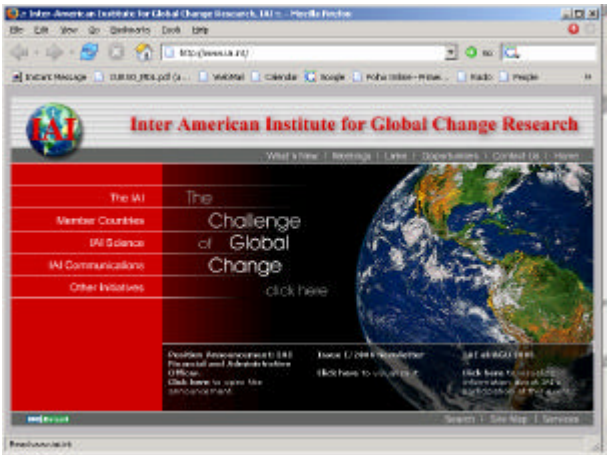
One issue of the IAI Newsletter was published during the fiscal year 2005-2006:

Number 1: 2006 (New numbering)

A new editorial board was established in May 2005 during the Institutional Meeting of the EC and CoP in Montreal, Canada. The members are Holm Tiessen (IAI Director), Carlos Ereño (Editor), Luis José Mata (SAC), Zoila Aquino (CoP, Gerhard Breulmann (Scientific Officer), Marcella Ohira (Training, Communications and Outreach Officer) and Ione Anderson (Program Manager).

The IAI Newsletter is available in English and Spanish; it is available in electronic form via the IAI website or may be ordered in hard copy from the website. Hard copies of the Newsletter are regularly distributed to approximately 4000 scientists and policy makers in the Americas and other regions.

The IAI Website



The IAI website makes the Institute's scientific and institutional information readily accessible to an international audience of groups and individuals. The site describes the IAI's establishment and development, mission and structure, member countries and representatives, institutional entities, and science agenda. In addition, the site provides information on funded research, announcements of current opportunities (such as calls for research proposals, training fellowships, and other programs), and the latest news about the IAI scientific community. The website provides access to the IAI's annual reports, newsletters, and scientific and institutional publications as well as links to project websites and other pertinent information. Users may also register there to receive the IAI Newsletter and Listserv messages. During fiscal year 2004 – 2005, the IAI website had nearly 80,000 visitors.

In addition to its main website, the IAI has established a site dedicated to its Training Institute (www.institutes.iai.int), which facilitates access to announcements of training opportunities; summaries of specific programs; lecture abstracts and reading material; selection criteria for participants; names and curriculum vitae of selected participants, coordinators, and invited speakers; and information on logistical arrangements.

The IAI Listserv

The IAI regularly uses e-mail to distribute information about its programs and grant opportunities as well as information from other global-change-related

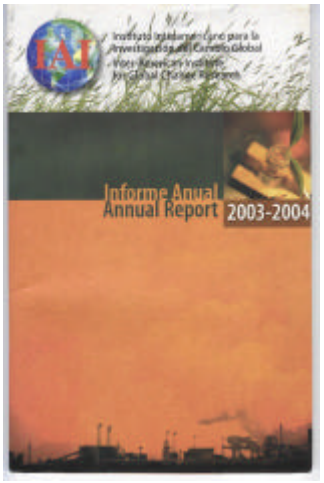
organizations. The Listserv announcements include calls for proposals, opportunities for training and education, upcoming workshops and seminars, job opportunities, etc. Any interested party may sign up on the IAI website to become a member of the IAI Listserv.

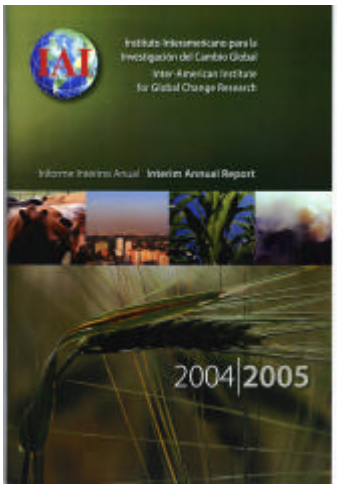
During the period July 2004 – June 2006, the IAI listserv distributed more than 120 announcements to approximately 10,844 recipients.

The Annual Report

The IAI publishes an annual or biennial report that summarizes the many activities of the Institute during the past fiscal year (July – June) or two years: institutional, scientific, programmatic, and financial (including a report by independent public accountants). All reports are available in English and Spanish as hard copies and — through the IAI website — in electronic format.

The Annual Report 2003 – 2004 was published in April 2005.
The Interim Annual Report 2004 – 2005 was produced in May 2006 for internal distribution (IAI entities only)





The Data and Information System

The IAI's Data and Information System (DIS) provides mechanisms for disseminating global change information produced by the IAI's scientific programs and by affiliated organizations. The system is an Internet-based application derived from the US's Oak Ridge National Laboratory Mercury System; its objectives are (1) dissemination of metadata from IAI scientific projects through both creation and management; (2) data discovery; and (3) contributions to the standardization and exchange of scientific data between investigators and institutions.

The DIS uses several chief mechanisms: the Metadata Editor (creates, edits, standardizes, and maintains metadata), the Search Process (identifies articles, presentations, posters, and other material produced by the IAI

Investigators); and the Harvest Process (collects metadata and then creates or updates the DIS index). The combination of these mechanisms results in an efficient and reliable system that allows investigators to summarize the focus of their research, document the data gathered, integrate project data with other data and information systems, and enhance collaborative work by providing free and open access to data.

The IAI is committed to maintaining the DIS — ensuring that it is continuously updated, user friendly, and integrated with other systems. In addition, the IAI stresses that all data produced by their scientific projects are documented within the DIS.

Scientific Publications

Each year, research projects supported by the IAI produce a significant number of publications — articles in scientific journals and periodicals, book chapters, etc. To access a list of these publications, please visit the IAI website at http://www.iai.int and select "IAI Communications — Scientific Publications." You will be taken to a section entitled IAI Projects, which is sorted by program and project number. The list of scientific publications is reproduced as it was provided to the IAI by the principal investigators of the individual projects (through June 2006).

IAI research publications are also listed in the IAI-DIS. Although not all publications are documented on this system, specific information can be found through search criteria such as keywords, project number, or responsible investigator. To access the system, visit the IAI-DIS Portal at http://disbr1.iai.int and select "DIS Search Tool" over "Hot Links." Begin a simple search by typing an expression or select the "Keywords" tab to add more detailed search criteria. For further information, access the links over "Visitor's Area" or contact iaidis@dir.iai.int.

Other Outreach Activities

IAI at the American Geophysical Union Joint Assembly 2005, New Orleans, Louisiana, USA., 23 – 27 May 2005

IAI was present at the 2005 Joint Assembly, a partnership between the AGU (American Geophysical Union), SEG (Society of Exploration Geophysicists), NABS (North-American Benthological Society), and SPD/AAS (Solar-Physics Division, American Astronomical Society), which was held 23 – 27 May 2005 at the Ernest N. Morial Convention Center, New Orleans, USA.

The Joint Assembly brought together more than 3500 earth and space scientists to present their latest scientific discoveries in fields as diverse as climate change, space weather, planetary exploration, volcanism and seismology, and the earth's magnetic field. The IAI announced the two training institutes held in 2005 and managed an exhibit booth where informational

material was distributed to participants. The IAI also used this opportunity to gather some of its principal investigators at an informal social occasion where they discussed project updates.

United Nations Framework Convention on Climate Change and Conference of the Parties Serving as the Meeting of the Parties to the Kyoto Protocol, Montreal, Canada, 28 November – 10 December 2005

At the 11th Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC) and the first Conference of the Parties serving as the Meeting of the Parties to the Kyoto Protocol (COP/MOP1), held in Montreal, Canada, 28 November – 10 December 2005, the IAI was admitted to observer status for sessions of the COP, COP/MOP, and subsidiary Bodies of the UNFCCC.

Being admitted to the CoP as an observer organization will ensure significant exchanges between scientists and policy-makers who recognize the need to better understand the natural and social processes that drive large-scale environmental change in the Americas.

Other Materials

In December 2004, the IAI produced a new institutional brochure, which contains an overview of the IAI, its mission, and science agenda, as well as current science and training programs and activities. This publication, distributed worldwide in meetings and training activities, is also mailed to partner organizations, donor agencies, and others. The IAI brochure is available in both English and Spanish.

In May 2005, the Institute distributed a multi-platform, multi-media mini-CD with information about its activities. This mini-CD was designed to be executed in MS-Windows, Linux, and Macintosh environments and offers a comprehensive group of files/articles: IAI Structure; Science Agenda; Science Program; Agreement Establishing the Institute; First Ten Years Book, Institutional Presentations and Infosheets, the latest published Annual Report, and IAI Newsletters.

In addition, a variety of materials, including information sheets describing several of the Institute's past programs, workshops, and general activities, can be downloaded from the IAI website and are also available as hard copies.

A joint IAI-Inter-American Institute for Cooperation in Agriculture (IICA) publication was produced as a result of the Science-Policy Forum of the *IAI-IHDP Global Environmental Change Institute on Food Systems and Globalization — Scientific Workshop and Science-Policy Forum (October 24 – November 6, 2004, Nicoya and San Jose, Costa Rica)*. This publication includes the proceedings of the Training Institute and papers about Food Systems and Security. The book is available in English and in Spanish.

Statement of Activities

(July 1, 2004 to June 30, 2005

	2005	2004
Revenue, Gains and Other Support		
Temporarily Restricted Revenues		
Contributions for Specific Programs	1.239.949	700.100
Unrestricted Revenues		
Requested contributions from member nations	945.000	945.000
Donated services, utilities and use of fixed assets	185.518	158.660
Interest income	3.322	3.329
Others	18.189	9.213
Total Revenues, Gains and Other Support	**2.391.978**	**1.816.302**
Expenses		
Research expenses		
Collaborative research network - CRN I	(111.319)	-
Small grants program II - SGPII	(245.915)	(9.531)
Training Institute - Jamaica	(3.239)	-
Other Programs	(45.065)	(123.692)
Core budget expenses		
Management and general expenses	(1.399.889)	(1.098.421)
Total Expenses	**(1.805.427)**	**(1.231.644)**
Change in Net Assets	586.551	584.658
Net Assets in the beggining of year	913.593	328.935
Net assets in the end of the year	**1.500.144**	**913.593**

Statement of Financial Position

(As of June 30, 2005)

	2005	2004
Assets		
Cash and Equivalents	520.848	1.532.512
Programs - Receivable Contributions	1.788.015	1.842.415
Programs - Advances	143.939	-
Other accounts receivable	5.913	25.733
Net Fixed Assets	26.990	25.598
Total Assets	**2.485.705**	**3.426.258**
Liabilities		
Current Liabilities		
Accounts payable	79.846	73.413
Advanced Core Budget Contributions	57.248	29.744
Programs - payable	848.467	2.409.508
Total Liabilities	**985.561**	**2.512.665**
Net Assets		
Temporarily restricted		
Scientific Programs	1.034.328	199.917
Unrestricted	465.816	713.676
Total Net Assets	**1.500.144**	**913.593**
Total Liabilities & Net Assets	**2.485.705**	**3.426.258**

Statement of Activities

(July 1, 2005 to June 30, 2006

	2006	2005
Revenue, Gains and Other Support		
Temporarily Restricted Revenues		
Contributions for Specific Programs	695.981	1.239.949
Unrestricted Revenues		
Contributions from member nations	572.524	945.000
Donated services, utilities and use of fixed assets	165.516	185.518
Interest income	3.052	3.322
Others	1.600	18.189
Total Revenues, Gains and Other Support	**1.438.673**	**2.391.978**
Expenses		
Research expenses		
Collaborative research network - CRN I	(185.632)	(111.319)
Collaborative research network - CRN II	(66.768)	-
Small grants program II - SGPII	(331.682)	(245.915)
Training Institutes	(209.897)	(3.239)
Other Programs	(10.000)	(45.065)
Core budget expenses		
Management and general expenses	(1.175.760)	(1.399.889)
Total Expenses	**(1.979.739)**	**(1.805.427)**
Change in Net Assets	(541.066)	586.551
Net Assets in the beggining of year	1.500.144	913.593
Net assets in the end of the year	**959.078**	**1.500.144**

Statement of Financial Position

(As of June 30, 2006)

	2005	2005
Assets		
Cash and Equivalents	789.905	520.848
Programs - Receivable Contributions	129.115	1.788.015
Programs - Advances	537.622	143.939
Other accounts receivable	21.094	5.913
Net Fixed Assets	18.147	26.990
Total Assets	**1.495.884**	**2.485.705**
Liabilities		
Current Liabilities		
Accounts payable	143.706	79.846
Advanced Core Budget Contributions	65.000	57.248
Programs - payable	328.100	848.467
Total Liabilities	**536.806**	**985.561**
Net Assets		
Temporarily restricted		
Scientific Programs	926.331	1.034.328
Unrestricted	32.747	465.816
Total Net Assets	**959.078**	**1.500.144**
Total Liabilities & Net Assets	**1.495.884**	**2.485.705**

Abbreviations and Acronyms

AARAM	Andean Amazon Rivers Analysis and Monitoring
AEB	Brazilian Space Agency (Brazil)
AGCM/CPTEC	The Atmospheric General Circulation Model of the Center for Weather Prediction and Climate Studies (Brazil)
AGU	American Geophysical Union
AIACC	Assessments of Impacts and Adaptations to Climate Change in Multiple Regions and Sectors
ANAM	National Authority of the Environment (Panama)
AO	Antarctic Oscillation
APN	Asia-Pacific Network for Global Change Research
ARGO	Program in the Colombian and Mexican Pacific
BLUE	Best Unbiased Linear Estimator
CE-CERT	Center for Environmental Research and Technology
CEMEDE	Mesoamerican Center for Sustainable Development of the Dry Tropics
CENAT	National Center of Advanced Technology (Costa Rica)
CESAR	Coastal Ecosystems of the South American Region
CICERO	Center for International Climate and Environmental Research
CICESE	Center for Scientific Research and Higher Education of Ensenada (Mexico)
CIFOR	Center for International Forestry Research
CIRAD	Centre for International Cooperation in Agronomic Research for Development
CLIVAR	Climate Variability and Predictability (WCRP)
CMM	Centre for Mathematical Modeling
CNCG	National Commission for Global Change (Argentina)
CNEA	National Commission of Atomic Energy (Argentina)
CNPq	Council for Technological and Scientific Development (Brazil)
CONICYT	National Commission for Scientific and Technological Research (Chile)
CoP	Conference of the Parties

CRN	Collaborative Research Network Program
CRRH	The Regional Committee of Water Resources of Central America (Costa Rica)
DAAD	German Academic Exchange Service
DIMEC	Department of Civil Mechanic Engineering
DIS	Data and Information System
EC	Executive Council
ENSO	El Niño—Southern Oscillation
EOF	Empirical Orthogonal Functions
FAC	Financial Administrative Council
FACEN	National University of Asuncion, the Faculty of Exact and Natural Sciences
FAO	United Nations Food and Agriculture Organization
FEALAC	Forum for East Asia – Latin America Cooperation
FUMEC	Mexico-United States Foundation
FUNCACYT	Foundation for Science and Technology (Ecuador)
FUNDECI	University of Costa Rica Foundation for Research (Costa Rica)
GEC	Global Environmental Change
GEF	Global Environmental Facility
GEIA	Global Emissions Inventory Activity
GLOBEC	Global Ocean Ecosystems Dynamics
GMA	Environmental Monitoring Group
GWSP	Global Water System Program
HCS	Humboldt current system
HURDAT	National Hurricane Center's North Atlantic Hurricane Database (Colombia)
IAI	Inter-American Institute for Global Change Research
IAPSO	International Association of the Physical Sciences of the Ocean
IAS	Intra-Americas Sea
IDEAM	Institute of Hydrology, Meteorology, and Environmental Studies
IDRC	International Development Research Centre

IFPRI	International Food Policy Research Institute
IFS	International Foundation for Science
IGBP	International Geosphere–Biosphere Programme
IGP	Peruvian Geophysical Institute
IHDP	International Human Dimensions Programme
IHDP	The International Human Dimensions Programme
IIASA	International Institute for Applied Systems Analysis
IICA	Inter-American Institute for Cooperation on Agriculture
IIGEO	Research Institute of the Faculty of Geologic, Mining and Geographic Engineering – University of San Marcos (Peru)
IMN	National Meteorological Institute (Costa Rica)
INE	National Ecology Institute (Mexico)
INPE	National Institute for Space Research (Brazil)
INPE/CPTEC	National Institute for Space Research/ Center for Weather Forecasting and Climate Studies (Brazil)
IOC	Intergovernmental Oceanographic Commission
IPCC	Intergovernmental Panel on Climate Change
IRI	International Research Institute for Climate Prediction
ISDR	United Nations International Strategy for Disaster Reduction
ISP	Initial Science Program
ITCZ	Intertropical Convergence Zone
ITM	Information Technology Manager
IVE	International Vehicle Emissions
LA&C	Latin America and the Caribbean
LBA	Large-Scale Biosphere–Atmosphere Experiment in Amazonia
LEAF	Landscape to Ecosystem: Across-scales Functioning in Changing Environments
LUCC	Land Use and Cover Change
MM5	Meso-Scale Model
MSD	Mid Summer Drought
MOP	Meeting of the Parties
NABS	North American Benthological Society
NASA	National Aeronautics and Space Administration
NAS-CR	National Academy of Science of Costa Rica

NCAR/ASP	National Center for Atmospheric Research/ Advanced Study Program (USA)
NCEP	National Center for Environmental Prediction (USA)
NEF	National Environmental Forum
NGOs	Non-Governmental Organizations
NOAA	National Oceanic & Atmospheric Administration
NSF	National Science Foundation
NSF	National Science Foundation (USA)
OdD (UCR)	Development Observatory of the University of Costa Rica
OOPC	Ocean Observing Panel for Climate
IGBP/PAGES	Past Global Environmental Changes
PAHO	Pan-American Health Organization
PDO	Pacific Decadal Oscillation
PDSI	Palmer Drought Severity Index
PESCA	Program to Expand the Scientific Capacity in the Americas
PI	Principal Investigator
PROSUL	South American Program for the Support of Cooperation Activities in Science and Technology
RUPSUR	Southern Pacific Universities Network
SAC	Scientific Advisory Committee
SACC	South Atlantic Climate Change Consortium
SACOS	South Atlantic Climate Observing System
SACZ	South Atlantic Convergence Zone
SAEMC	South American Emissions, Megacities, and Climate
SALLJEX	South America Low-Level Jet Experiment
SCOPE	Scientific Committee on Problems of the Environment
SEG	Society of Exploration Geophysicists
SENACYT	National Secretariat of Science and Technology (Ecuador)
SG	Start-Up Grants
SGP	Small Grants Program
SICA	Central American Integration System
SPD/AAS	Solar Physics Division/ American Astronomical Society
SST	Sea-Surface Temperature

START	System for Analysis, Research, and Training (in Global Change)
START	The Systems for Analysis, Research and Training
T&E	Training and Education
TIs	Training Institutes
TISG	Training Institute Seed Grant
UAM	Autonomous University of Mexico
UAQ	Chemical Activity Unit
UCR	University of Costa Rica
UFRG	Federal University of Rio Grande do Sul (Brazil)
UMESAM	Urban Mobile Emissions in South American Megacities
UN	United Nations
UNA	National University of Asunción (Paraguay)
UNAM	Autonomous University of Mexico
UNAM	National Autonomous University of Mexico (Mexico)
UNCBD	UN Secretariat of the Convention on Biological Diversity
UNCR	National University of Costa Rica
UNEP	United Nations Environmental Program
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention for Climate Change
USA	United States of America
USAID	United States Agency for International Development
USON	University of Sonora (Mexico)
USP	University of São Paulo (Brazil)
USP/CENA	University of São Paulo/ Center for Nuclear Energy Applied to Agriculture
WCRP	World Climate Research Programme
WCRP/GOOS	World Climate Research Program/ The Global Ocean Observing System
WMO	The United Nations World Meteorological Organization
ZEF	Center for Environmental Science

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