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The RedCLARA Network supports the Millennium Development Goals

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Abstract:

This document describes in how far the RedCLARA network supports the Millennium Development Goals.

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TABLE OF CONTENTS

Executive Summary	5
1. <i>Reduction of Extreme Poverty and Hunger</i>	6
1.1 Agricultural Research across the Globe (CGIAR)	6
1.2 Effective Adaptation Strategies and Risk Reduction towards Economic and Climate Shocks: Lessons from the Coffee Crisis in Mesoamerica	6
1.3 CLARIS	6
1.4 EELA Project	7
2. <i>Health Improvement and Disease Control</i>	8
2.1 Centro Rosarino de Estudios Perinatales	8
2.2 T@lmed	8
2.3 SICOT: The World Orthopaedic Organisation	8
2.4 RUTE: Red Universitaria de Telemedicina	9
2.5 EELA WISDOM (Wide In Silico Docking of Malaria)	9
2.6 Development of Virtual Surgery at the Hospital Clínico Universitario de Caracas	9
2.7 Plasmodium vivax Infections in Pregnancy	9
2.8 Health Reform in Uruguay	10
2.9 Development of new anti-bacterial medication	10
2.10 National Plan for Telemedicine and Telehealth in Ecuador	10
2.11 Telehealth Public Policies in Latin America – TPP-LA, Brazil	10
2.12 Molecular mechanisms of signalling in fatty acid synthesis of Gram-positive bacteria	11
2.13 In silico design of FRET/BRET-based sensors for probing protein-protein interactions	11

2.14	Implementing Public Health Programs and Strengthening Public Health Science in Guatemala and the Central American Region.....	11
	3. <i>Education</i>	12
3.1	Advanced Networks to support Primary and Secondary Education.....	12
3.2	Integration of educational communities via ICT to improve the content development and the quality and equality in education.....	12
3.3	Free Software for the improvement of learning	12
3.4	Multimedia dissemination via wireless IP services.....	12
3.5	Methodologies and processes for the design, development and use of Learning Objects	13
3.6	Implementation of an interuniversity digital channel using HDTV technology over IP.....	13
3.7	Implementation of e-learning platforms.....	13
	4. <i>Environmental Sustainability</i>	14
4.1	The Large Scale Biosphere-Atmosphere Experiment in Amazonia (LBA)	14
4.2	Development of applications that help prevent problems generated by climate change and environmental challenges.....	14
4.3	Development of a network of bioclimatic stations across the State of Merida in Venezuela (REDBC)	14
4.4	Mexican Network for Ecological Research.....	14
4.5	Inter American Institute for Global Change Research (IAI)	14
	5. <i>Global Partnership for Development</i>	16
5.1	ONTI National Office for Information Technology in Argentina;	16

Executive Summary

The question has been raised in how far an infrastructure project such as RedCLARA supports the Millennium Development Goals (MDGs). This document is to address this question by providing practical examples of applications running over RedCLARA within Latin America and between Latin America and Europe that support the MDGs.

The role of ICTs for development poverty reduction has been widely demonstrated in several strategic papers and communications. For instance, the World Bank report on “the Network revolution and the Developing World” (2000) demonstrated the macro-level correlation of development progress and telecommunications progress and showed the importance of communication and information for development, both in the commercial and the public sector. Many publications today point out the need for ICT supported applications in education and health, in the reduction of the impact of environmental and climate changes and the research carried out on agricultural products. In all these areas a research and education infrastructure such as RedCLARA in Latin America plays an integral part. RedCLARA’s link to the European GEANT2 network ensures connectivity on a global scale, thus enabling research collaboration and networking across the world.

The following chapters give concrete examples from across Latin American institutions connected to RedCLARA and show in how far RedCLARA and its interconnection to GEANT2 support the Millennium Development Goals related to the Reduction of Extreme Poverty and Hunger, Health Improvement and Disease Control, Education, Environmental Sustainability and Global Partnership for Development. It is to be noted that the projects and activities listed in the following chapters are not exclusive, but reflect the findings of a brief study across the connected LA-NRENS carried out during November 2007.

1. Reduction of Extreme Poverty and Hunger

Agricultural Research and Climate Change Programmes are carried out via RedCLARA and its interconnection to the European GEANT2 network. The following paragraphs describe several projects and activities carried out via RedCLARA and its interconnection to GEANT2 and show the impact these programmes have on the reduction of extreme poverty and hunger.

1.1 Agricultural Research across the Globe (CGIAR)

CGIAR is a group of 15 agricultural research centres across the globe which share the mission “to achieve sustainable food security and reduce poverty in developing countries through scientific research and research-related activities in the fields of agriculture”.

The International Potato Center (CIP) in Peru, the Mexican International Maize and Wheat Improvement Center (CIMMYT) or the Agricultural researchers at the International Centre for Tropical Research (CIAT) in Cali, Colombia are connected via RedCLARA. Their interconnection via RedCLARA supports the crop research carried out in collaborate activities in the Latin American centres, but also their activities with researchers worldwide – one example is the ongoing collaboration between the CIMMYT in Mexico and the Philippine International Rice Research Institute (IRRI). IRRI is connected to TEIN2 the Asian Pacific regional research and education network. The intercontinental collaboration via RedCLARA-GEANT2-TEIN2 accelerates the development of new crops which have the potential to raise the income of millions of farmers.

Since 2005 the Peruvian CIP has implemented a Grid of HPC Cluster systems managed from its headquarters in Lima (Peru), with connectivity to RedCLARA via the Peruvian partner RAAP. The Cluster Grid system at CIP is dedicated to advances in molecular biology and biotechnology, based on germplasm and crop information systems and bioinformatics resources, at the service of all collaborating scientists and partners under the auspices of the global Generation Challenge Program (GCP) project.

The specific goal was to establish a Cluster Grid HPC facility for bioinformatics and similar high throughput scientific computing, based on the LINUX operating system, with future scalability to increase bioinformatics throughput through the addition of further nodes and/or compatible specialized accelerator hardware.

The broad goal is “to use plant genetic diversity, advanced genomic science, and comparative biology to develop tools and technologies that help plant breeders in the developing world produce better crop varieties for resource-poor farmers”.

1.2 Effective Adaptation Strategies and Risk Reduction towards Economic and Climate Shocks: Lessons from the Coffee Crisis in Mesoamerica

Since the beginning of 2007, this project has been carried out by the Centro de Estudios Ambientales of Uruguay. It studies the evolving livelihood strategies of coffee growers in four countries: Mexico, Guatemala, Honduras, and Costa Rica, in the face of multiple stress factors: market shocks and price volatility; climatic variability and trends; and the rising incidence of pests in coffee producing regions. The project is financed by the Inter American Institute for Global Change Research (IAI) and it involves five research universities, one government institution and one non-government institution from four different countries interconnected via RedCLARA.

1.3 CLARIS

Another example where RedCLARA contributes to the first MDG are climate change programmes, such as the European and Latin American CLARIS project (www.claris-eu.org) led by the French Centre National de la Recherche Scientifique and with European partner organisations connected to GEANT2 and Latin American partner organisations in Argentina, Brazil, Chile and Uruguay, all connected to RedCLARA.

The goal of the CLARIS project is to build an integrated European-South American network dedicated to promote common research strategies to observe and predict climate changes and their consequent socio-economic impacts taking into account the climate and societal peculiarities of South America.

Deliverables of the CLARIS project demonstrate the collaborative effort that has been carried out in the area of climate change risk assessment for South America and the impact of climate change on agriculture and crops and also the associated spread of the Dengue Mosquito responsible for the Dengue fever. In this area climatology research ties in with the sixth MDG the reversing of the incidence of major diseases.

1.4 EELA Project

Within the framework of the EELA Project (www.eu-eela.org), a Grid Sequence of Climate application is being developed in a collaborative effort between institutions in Spain, Peru and Chile, all of them connected to GÉANT 2 and RedCLARA, respectively.

The goal of the project is to obtain a better understanding of how the “El Niño” phenomenon affects the regional climatic variability and the challenge is to unravel the different patterns of climate variability through different processes.

From the scientific point of view, the main goal is to obtain a better understanding of how the events like El Niño affect the regional climatic variability. That means how micro climate systems, like a region or a river basin, are affected by climate variations produced by local or remote phenomena, mainly in Peru and Chile, since they are influenced by “El Niño”.

From the technical point of view the great challenge consists in making these simulations and data mining in a Grid environment that allows the collaboration and the access to results and remote data of the different centers involved in the study. In this point RedCLARA offers a great opportunity of technical and scientific development between institutions geographically separated.

2. Health Improvement and Disease Control

Various activities and projects that make use of RedCLARA and GEANT2 address the Millennium Development Goals no. 4, 5 and 6 in the area of health improvement and disease control (see also the CLARIS activity above). Several of these projects will be described in the paragraphs below.

2.1 Centro Rosarino de Estudios Perinatales

The Centro Rosarino de Estudios Perinatales connected to the Argentine NREN Innova-Red participates in VIT@LIS. VIT@LIS is the most extended, numerous and inclusive network between Europe and Latin America devoted to issues related to the Information Society. Its mission is to strengthen collaboration between both regions and to capitalize on the many results and existing projects by facilitating the adoption and transfer of successful practices while helping to create new projects.

VIT@LIS supports the Maternal and Fetal Neonatal Portal. This portal is intended for health care workers across Latin America and the Caribbean as a useful tool to interact, disseminate and communicate matters related to prenatal care and reproductive health. It involves more than 30 institutions throughout Latin America and the Caribbean responsible for health care in pregnancy, labour, post-partum, newborn and related issues such as epidemiology and reproductive health

2.2 T@lemed

In the most remote parts of the world, access to the types of healthcare services taken for granted by urban populations is just not possible. Many small, rural communities in Latin America can support a local health centre or clinic, but medical specialists are only available in provincial centres. The aim of the T@lemed project is to bring some of the essential healthcare services available in a large, general hospital to outlying districts. It uses specialist equipment and software developed by Medcom at the Fraunhofer Institute in Germany, and utilises the Brazilian national research network, RNP. The infrastructure provided by RedCLARA and GÉANT2 networks made it possible to consult with expert doctors thousands of kilometres away from the patient. T@lemed is also working within Colombia to provide health services to treat malaria. The initiative links specialist centres in Bogotá and Cali to remote rural regions of the Amazon, and the Pacific Coast. Colombia's connection to RedCLARA gives access to region-wide facilities and specialists in malaria treatment and prevention.

The telemedicine process starts at a remote clinic, many hours travel from the nearest hospital. The clinic's dedicated, portable equipment allows patients to be scanned for a variety of conditions from pregnancy to cancer. The local doctor is able to electronically transfer images, measurement data and case descriptions over the national research network, RNP, to a hospital in a provincial centre. There, the image can be viewed immediately and a real-time video-conference discussion can take place between the hospital specialists and the referring doctor in the remote clinic. Should there be any doubt in the diagnosis, or if the condition requires particularly specialist knowledge, the image may then be passed on electronically to another hospital within Brazil or, using RedCLARA's transatlantic link, to Europe. The capacity of the RedCLARA and GÉANT2 networks means that high resolution images and large data files can be transferred almost instantaneously to waiting specialists for rapid advice. The networks also allow immediate feedback of the diagnosis and the request of additional information or further scans.

2.3 SICOT: The World Orthopaedic Organisation

SICOT is an international not-for-profit association incorporated under Belgian law with the aim to advance the science and art of orthopaedics and traumatology at an international level and to foster and develop teaching, research and education.

RedCLARA has in several instances supported SICOT events, conferences and teaching seminars in the areas of road accident traumatology and general orthopedics. On November 14, 2007, SICOT will organise the Fifth Global Forum on Road Traffic Trauma with a specific focus on Latin America. RedCLARA will interconnect venues at hospitals and universities in

Santiago, Mexico City, Guadalajara (MX), Lima, Quito, Sao Paulo, Rio de Janeiro and other Brazilian cities.

2.4 RUTE: Red Universitaria de Telemedicina

The RUTE e-health network is currently being established in Brazil (www.rute.rnp.br). Cooperation and collaboration is envisaged with other Latin American national e-health initiatives, such as the Mexican CENETEC programme or the Ecuadorian e-health network initiative led by CEDIA. RUTE focuses on e-health applications in the areas of dermatology, oncology, radiology, surgery, cardiology, psychiatry, home care, rehabilitation, pediatrics, obstetrics, gynecology and neurology and also looks at teaching telemedicine disciplines in the Universities' health faculties. Again, the participating institutions in Brazil are connected to RNP and RedCLARA which enables the close collaboration with e-health initiatives globally.

2.5 EELA WISDOM (Wide In Silico Docking of Malaria)

The objective of WISDOM is the creation of new inhibitors for a family of proteins produced by *Plasmodium falciparum*. This protozoan parasite causes malaria and affects around three hundred million people and more than 4 thousand people die daily in the world. Drug resistance has emerged for all classes of antimalarials except artemisinins. The main reason is that the available drugs focus on a limited number of biological targets, producing a cross-resistance to antimalarials. There is a consensus that substantial scientific effort is needed to identify new targets for antimalarials. The main problem is that the development of new drugs with new targets is a costly and lengthy process, and the economic profit is not clear for the drug manufacturers.

This application consists on the deployment of a high throughput virtual screening platform in the perspective of in silico drug discovery for neglected diseases. The WISDOM platform has performed its second High-Throughput virtual Docking of million of chemical compounds available in the databases of ligands to several targets. ULA (University of Los Andes - Venezuela, connected to RedCLARA) proposed two targets for *Plasmodium vivax* to the WISDOM Consortium and, after their approval, they are being docked in the EELA e-infrastructure under the coordination of UPV (Universidad Politécnica de Valencia – Spain, connected to GÉANT2).

The reason for choosing these targets is the higher importance of *P. vivax* in Latin America over *P. falciparum*. The scientific analysis of the results has already started in the 53 GB of data produced only for the first target, which was docked with the executions of the necessary 2422 jobs (1 CPU day each).

2.6 Development of Virtual Surgery at the Hospital Clínico Universitario de Caracas

This project creates a virtual space for students and traumatologists at the University Hospital in Caracas to offer cost effective training facilities as well as the possibility to plan difficult surgery. The project's objective is to lower the costs of interventions, to reduce the time a patient spends in the surgery and to offer safer surgery to patients. In addition, the project allows the doctors and students based at the Bioenergetic Centre of the Engineering Faculty (CEBIO) to visualise the resistance of bone material and certain alternative materials, to enhance the building of prostheses. It is envisaged that students and doctors at Universities across Venezuela will be able to remotely make use of the facility using the Venezuelan NREN, REACCIUN.

2.7 Plasmodium vivax Infections in Pregnancy

The combat against malaria during pregnancy has been prioritized by the as a worldwide strategy to reduce malaria and achieving the MDG. The *Plasmodium vivax* Infections in Pregnancy project is being carried collaboratively among institutions across Spain, Sweden, India, Papua New Guinea, Brazil, Colombia and Guatemala.

The main objective of the project is to describe the epidemiological and clinical features of *Plasmodium vivax* malaria in pregnancy. In addition, the project will determine if there are pregnancy-specific immune responses and characterize genotypically parasites of the placenta. The project is a four year multicentre study between nine partners and makes use of the RedCLARA network and its interconnection to GEANT2 as it has the need for

computer-base resources for data sharing, analysis videoconferences and continues communication between all partners.

2.8 Health Reform in Uruguay

The Uruguayan Health reform plans to build an interconnection network between all hospitals in the country. It is currently being discussed to use the Uruguayan NREN RAU and the RedCLARA networks to accommodate the data communication needs of the hospitals in Uruguay. Negotiations are ongoing between the Red de Hospitales Universitarios, de Salud Pública, etc., the Health Ministry and the NREN, RAU.

The Hospital de Clínicas (Hospital Universitario), the biggest hospital in Uruguay is already connected via RAU and the connection to the biggest public health hospital in Montevideo is currently being implemented.

2.9 Development of new anti-bacterial medication

The Universidad de la Frontera, the University of Chile and the University Federal de Sao Paulo are currently making use of their connectivity via RedCLARA for the development of a new anti-bacterial drug which uses as its principal active ingredient the poison from the Chilean native spider called "Lactrodectus marans".

2.10 National Plan for Telemedicine and Telehealth in Ecuador

Telemedicine and Telehealth are important means to improve health conditions in rural and marginal regions of Ecuador. This is the reason why for some time now Universities and National Foundations have been working with these topics, however, these collaborations have historically suffered from poor cooperation between them. The current national government has declared the creation of a National Plan for Telemedicine and Telehealth. This statement has coincided with the opportunity to participate in a proposal, for Telehealth and Telemedicine regional policies, lead by CLARA to be presented before the Inter-American Development Bank. It was possible for Ecuador to be involved in this proposal with the cooperation of a National Foundation in Telemedicine, the National Research and Education Network (CEDIA), and the National Government.

Some of the ongoing telehealth projects benefiting from the new plan will be

2.10.1 Telesalud Rural TUTU PALY

The Universidad Técnica Particular de Loja (UTPL) in Ecuador is currently involved in a rural telehealth project attending the province of Zamora Chinchipe in the Ecuadorian rain forest region

2.10.2 Telemedicine Network for Marginal Regions

FUNDATEL and the Universidad San Francisco de Quito (USFQ) in Ecuador are carrying out this project in the Ecuadorian provinces of Cotopaxi, Galápagos, Esmeraldas.

2.10.3 Pilot Telemedicine Project for Península Santa Elena

The CEDIA connected Escuela Superior Politécnica Del Litoral carries out a telemedicine pilot in the Ecuadorian regions of Guayas and Santa Elena.

2.10.4 Telemedicine for Mobile Surgery

This project is being carried out by the Universidad Tecnológica Equinoccial and attends the Ecuadorian provinces of Orellana (situated in the Ecuadorian rain forest) and Galápagos

2.11 Telehealth Public Policies in Latin America – TPP-LA, Brazil

The objective of the project is to build an organising process for the establishment of rules and regulations for the implementation of national telehealth policies in Latin America through discussions of ongoing experiences in this field. The project makes accessible structuring experiences of national networks and as a result leverages the development of technological structures able to connect different health care units at a reasonable price. The objective of the project is to boost the development of telehealth across Latin America.

Twelve universities, institutions and the NRENs from Brazil, Ecuador, Colombia and Mexico cooperate in this project together with CLARA the organisation responsible for running the Latin American RedCLARA network. The project has been proposed to the International Development Bank.

2.12 Molecular mechanisms of signalling in fatty acid synthesis of Gram-positive bacteria

In order to fight infectious diseases, the Institut Pasteur of Montevideo realises studies on the molecular understanding of lipid biosynthesis regulations in Gram+ bacteria. The validation of the structural hypotheses will contribute to the identification and design of novel antibiotic molecules.

Two Latin American and one European institution collaborate in the project, based in Uruguay, Argentina and France. The participating institutions from LA are connected to RedCLARA through the NREN in their countries, allowing them a fluid communication with Europe.

2.13 In silico design of FRET/BRET-based sensors for probing protein-protein interactions

This project is enrolled within the framework of the FP6-2005-LIFESCIHEALTH-6 of the EC. Identification of therapeutic molecules to target compartmentalised cAMP signalling networks in human disease.

It is a widely interdisciplinary project based on a post-genomic investigation oriented to identify new components with therapeutic potentialities. The compounds are focused to take part of metabolic ways, modulating interactions protein/protein involved in cellular models of cardiovascular, renal and the immune systems.

The group of BioMolecular simulation, located at the Pasteur Institute of Montevideo, makes calculations about protein systems, locally or in computer centres in different institutions in Europe. These calculations generate a big volume of information that must be accessible to other participant groups of the project.

In this project eight institutions from Europe and RAU cooperate with the Institut Pasteur of Montevideo, in Uruguay, connected to RedCLARA.

2.14 Implementing Public Health Programs and Strengthening Public Health Science in Guatemala and the Central American Region

A cooperative agreement is underway between the Centre for Health Studies, Universidad del Valle de Guatemala (UVG), and the U.S. Centres for Disease Control and Prevention (CDC).

A total of 13 projects are included in the cooperative agreement. These projects will contribute to improve public health programs and science in the Central American region, and are conceptualised based on the assessment of public health needs and the recommendations of the Health Summit for the Americas. The major strategies include the implementation, monitoring, evaluation, support, promotion and capacity building in infectious disease prevention and control programs, surveillance and laboratory systems, and health emergency response. Internet connectivity is essential for effective communication and coordination with all partners in region as well as for the exchange of technical information and virtual training. The project involves institutions connected to RAGIE in Guatemala and other NRENs across LA.

3. Education

Enhancing ICT capabilities will help reduce the 'brain drain' of talented researchers and academics, and enable in-country centres of excellence to be set up, and equip the educational sector with the tools and capabilities necessary for the 21 century. Equipping developing countries with high quality education at university level will lead to an educated civil society essential for any country in development. Experience to date shows that supporting international ICT infrastructure development catalyses countries to invest in their national infrastructures and human capabilities.

It has already been demonstrated that RedCLARA and EuropeAid's ALFA programme on Higher Education produce many synergies. "ALI-06-032v2 ALFA and ALICE" (as submitted) showed that in 2006 a total of 62% of the universities participating in ALFA also had access to RedCLARA via the National Research and Education Network. It has to be noted that in some countries this percentage was significantly higher such as in Guatemala and Nicaragua (both 100%), or Mexico (82%) and Brazil (74%). The access to RedCLARA allows for closer collaboration in European and Latin American Education Cooperation and it is hoped that a successor of the ALFA programme will ensure the increased use of e-education tools between the European and Latin American partners.

RedCLARA also complements the EC-funded programme for higher education development (Erasmus Mundus).

The following paragraphs will highlight some additional educational projects currently being carried out via the RedCLARA infrastructure.

3.1 Advanced Networks to support Primary and Secondary Education

The project is a joint effort for the remote and isolated Mexican region of Tabasco. The project is carried out in collaboration between the Universidad Juárez Autónoma de Tabasco, the State Secretary of Education for Tabasco, the Instituto Latinoamericano de la Comunicación Educativa (ILCE) and the Mexican NREN, CUDI.

Making use of WIMAX technology and the CUDI infrastructure primary and secondary schools in the Tabasco region receive access to information technologies in a very cost-effective way. This allows for the implementation of projects which will be supporting both professors and students. Applications carried out include the development of collaborative projects between students making use of video conferences and application available in the Mexican School Network, the use of digital classrooms, education at a distance for professors and remote scientific presentations for students.

3.2 Integration of educational communities via ICT to improve the content development and the quality and equality in education

This project is currently being carried out between the Universities in Chile, Argentina, Mexico, Peru and Spain and also counts on the collaboration with various research institutions in these countries. The impact of the project is in the area of educational science and the formation of university professors.

3.3 Free Software for the improvement of learning

The project carries our scientific, educational and technical activities which allow for the creation of knowledge and the implementation for projects related to the free access of knowledge across Latin America. The project is being carried out between Universities and Research centres in Brazil, Chile, Colombia, Mexico, Portugal and Spain.

3.4 Multimedia dissemination via wireless IP services

This project developed a wireless system for the dissemination multimedia of multimedia content across the Chilean REUNA backbone. The project was carried out in the framework of the Chilean Educational Reform

3.5 Methodologies and processes for the design, development and use of Learning Objects

This project is carried out in a collaboration of various universities in Mexico, Argentina and Chile. The project impact is in the area of educational science and the formation of university professors.

3.6 Implementation of an interuniversity digital channel using HDTV technology over IP

The project will implement a channel between various universities across Panama to present distinguished programmes in the area of national and international science and technology. The implementation will make use of HDTV technology over IP. The project is a collaborative effort between the Universidad Santa María La Antigua (USMA, Panamá), the Sistema Estatal de Radio y Televisión (SERTV, Panamá) and I2CAT in Spain.

3.7 Implementation of e-learning platforms

The project aims at the implementation of a low-cost, open-source, tolerant and robust e-learning platform which has the capability to support very many users and offers functionality for professors and students. The project is being carried out between the Universidad Panamá (UP) and the Centro de Alta Tecnología de Educación a Distancia (CATED, part of the Universidad Nacional Autónoma de México, UNAM)

4. Environmental Sustainability

Various projects are currently being carried out via RedCLARA and its interconnection to GEANT2 in the area of environment, environmental studies and protection. The following paragraphs describe some of these activities.

4.1 The Large Scale Biosphere-Atmosphere Experiment in Amazonia (LBA)

The Large Scale Biosphere-Atmosphere Experiment in Amazonia (LBA) is an international research initiative led by Brazil. LBA is designed to create the new knowledge needed to understand the climatologic, ecological, biogeochemical, and hydrological functioning of Amazonia, the impact of land use change on these functions, and the interactions between Amazonia and the Earth system. Around 150 research institutions in 15 countries collaborate in this project. The LBA project uses the Brazilian and the Latin-American NRENs, Ipê and RedCLARA, for data transmission over Brazil and other countries.

4.2 Development of applications that help prevent problems generated by climate change and environmental challenges

This project will be carried out in Ecuador and it is envisaged that the applications developed by the project partners CIIFEN, INOCAR and CENAIM will help the Ecuadorian farmers and citizens. It is planned to make websites available which provide information about climatic risk in the Ecuadorian regions.

4.3 Development of a network of bioclimatic stations across the State of Merida in Venezuela (REDBC)

This initiative will capture, process and disseminate the climatic, environmental and ecological information gathered via an information system and communication mechanisms. Currently the data of 6 meteorological stations are being gathered. The systems will allow other institutions and individuals to submit the information gathered in their station and will provide a consolidated, stable and continuous environment for climatic measurements in Venezuela.

4.4 Mexican Network for Ecological Research

The Mexican Network for Ecological Research will bring together those Mexican scientists carrying out research on physical processes, biological and social determinants in the structure and functioning of aquatic and terrestrial ecosystems. This will allow for the creation of a common research platform and will enable the comparison of findings and the storage of the generated data. The objective is to be able to have a database of defined, executed and well documented measurements and experiments for future generations.

4.5 Inter American Institute for Global Change Research (IAI)

The InterAmerican Institute for Global Change is an intergovernmental organisation supported by 19 countries in the Americas, with the mission “to develop the capacity of understanding the integrated impact of present and future global change on regional and continental environments in the Americas and to promote collaborative research and informed action at all levels”.

Collaborative Research Network Program II (CRN): 12 Grants are funded under this programme. The programme promotes research cooperation and exchange of information in an integrated way through interdisciplinary studies and international networks involving at least 4 countries in each project. The IAI is investing approximately US\$10.4 million for the period 2006-2011.

The use of RedCLARA is a great opportunity to fortify the collaboration for the optimal development of these projects.

Project Title	Participant Countries
From Landscape to Ecosystem: Across-scales Functioning in Changing Environments	Argentina, Brazil, Canada, Germany, Venezuela
Links between aboveground changes and belowground activity	Bolivia, Brazil, Canada, Chile,

with land use in the Americas: Soil biodiversity and food security.	Ecuador, Mexico, USA
Functional biodiversity effects on ecosystem processes, ecosystem services and sustainability in the Americas	Argentina, Bolivia, Brazil, Costa Rica, USA
South American Emissions, Megacities, and Climate	Argentina, Brazil, Colombia, USA
Human, Ecological and Biophysical Dimensions of Tropical Dry Forests	Brazil, Canada, Costa Rica, 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	Argentina, Brazil, Paraguay, Uruguay, USA
Documenting, understanding and projecting changes in the hydrological cycle in the American Cordillera	Argentina, Bolivia, Brazil, Canada, Chile, Mexico, USA
Tropical cyclones: current characteristics and potential changes under a warmer climate	Costa Rica, Mexico, USA
Paleotempestology of the Caribbean Region: A Multi-proxy Study of the Spatial and Temporal Variability of Caribbean Hurricane Activity	Canada, Costa Rica, Mexico, USA
Effective Adaptation Strategies and Risk Reduction towards Economic and Climatic Shocks: Lessons from the Coffee Crisis in Mesoamerica	Costa Rica, Guatemala, Mexico, USA
Caribbean Coastal Scenarios	Dominican R., Jamaica, USA
SACC: An International Consortium for the Study of Oceanic Related Global and Climate Changes in South America	Argentina, Brazil, Chile, Uruguay, USA

5. Global Partnership for Development

RedCLARA and the connected Latin American NRENs are encouraging innovation through research and the development of new ICT services within their countries and in the Latin America region. This innovation will have pull through effects to stimulate the development of the private sectors. The research projects using the network can be expected to lead to commercial exploitations to the benefit of the private sector in the partner countries.

RedCLARA complements the participation by Latin American countries in the EC's Framework Programme for Research and Technological Development. By helping to bridge the digital divide between the developing and the developed countries, RedCLARA underpins the core development goals for the Latin American countries.

5.1 ONTI National Office for Information Technology in Argentina;

The objective of ONTI is the introduction of best practices in all areas of government through ICT to improve transparency and interoperability. ONTI in Argentina participates in VIT@LIS. VIT@LIS is the most extended, numerous and inclusive network between Europe and Latin America devoted to issues related to the Information Society. Its mission is to strengthen collaboration between both regions and to capitalize on the many results and existing projects by facilitating the adoption and transfer of successful practices while helping to create new projects.