Climate change and poverty in **Latin America** and the **Caribbean.**
A consultation process

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diálogo, capacidades y desarrollo sostenible

Report Submitted by Fundación Futuro Latinoamericano to The International Development Research Center (IDRC) and the Department for International Development of the United Kingdom (DFID)

October, 2008
Quito, Ecuador

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Credits

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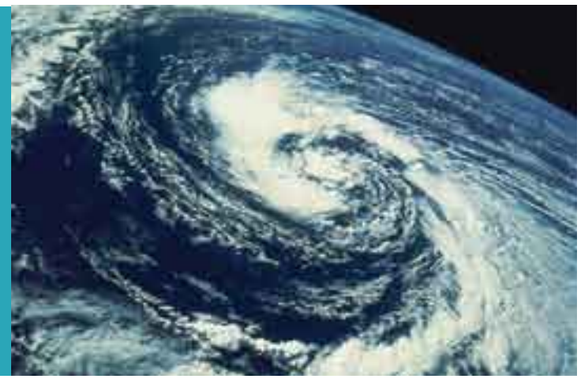

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Project Team at FFLA

The regional consultation process was led by Yolanda Kakabadse and the final report was prepared by Juan Dumas. Gabriela Encalada was in charge of day-to-day management and consultation to vulnerable communities in the Andean Region. Paulina Campodónico provided substantial assistance to the project team and, together with Gabriela Erazo and Fernanda Albuja, played a key role in the literature review process. Mónica Román, Jennifer Velasco, Geovanna Torres and Jorge Chávez provided the administrative and financial support.

Executive Summary

The International Development Research Center (IDRC) and the Department for International Development of the United Kingdom (DFID), as leaders in funding research to support development, have a commitment to strengthen the capacity of developing countries to assess and address the threat that climate change puts on development and poverty alleviation. Both institutions initiated a consultation process to inform their research programs to effectively assist countries in Latin America and the Caribbean (LAC) and Asia in tackling climate change. The potential impact of these programs will be maximized if they accurately address the real needs of the most vulnerable populations and if they are able to build upon current adaptation and mitigation efforts undertaken by Asian, Latin American and Caribbean societies.

To conduct this consultation process in LAC, IDRC and DFID have relied on Fundación Futuro Latinoamericano (FFLA – www.ffla.net), a non-profit organization based in Quito, Ecuador, committed to promoting constructive dialogue, capacity building, and stakeholder engagement for sustainable development.

The main objective of this project has been to identify, through a process of regional consultations, the information gaps, knowledge requirements of relevant stakeholders, and the state of existing capacity and needs of the most vulnerable populations in LAC, to cope with the impacts of climate change.

The project took off in November 2007. Based on experience in previous consultations and policy dialogues conducted by FFLA, dialogue amongst different sectors provides a good opportunity to exchange information and allow for cross-fertilization and integration of ideas, proposals and strengths. Understanding of the others' needs and views leads to integrated agendas supported by different sectors. This rationale led IDRC, DFID and FFLA to opt for a geographic – rather than sectorial – focus to organize the consultation process. The Cropper Foundation in Trinidad & Tobago, the Latin-American Centre for Competitiveness and Sustainable Development (CLACDS) of the INCAE Business School in Costa Rica, and RIDES (Resources and Research for Sustainable Development) in Chile were invited as partners to organize sub-regional consultations in the Caribbean, Mesoamerica and the Southern Cone, respectively. FFLA was responsible for the consultation in the Andean zone.

Methodologies, procedures and expectations were discussed and agreed-upon during an inception meeting. Main stakeholders to be consulted through workshops were government, private sector, academia and NGOs. The group also agreed to (a) approach a few vulnerable communities to enquire about main concerns and responses to climate change and (b) to identify and list existing literature on climate change issues produced by international, national and local organizations in each sub-region. After four sub-regional workshops, various interviews with vulnerable communities, extensive literature review, and a final regional workshop, important information and knowledge gaps were identified and research needs outlined.

Even though each sub-region has its own specific concerns, it is quite clear that they share certain similarities across sectors and issues, and, therefore, common information and research needs:

- Considering LAC's minimal contribution to global Green-House Gas (GHG) emissions and the risks associated to the impact of climate change on the poor, adaptation to climate change was given a priority focus. Mitigation was only considered important in different sub-regions when linked to vulnerability reduction. All adaptation efforts should be built on the existing knowledge that vulnerable communities have already accumulated from their long-term experience of adapting to climate variability.

- There is a need to estimate the potential economic impact of climate change and the costs associated to adaptation options (including the choice of inaction). This information should be of strategic use to draw the attention of governments and the private sector, which still tend to view climate change as an environmental problem.

- Climate change scenarios need to be downscaled as much as possible if they are to be useful to local communities. Related to this, priority was given to the need to design and implement early warning systems for vulnerable communities and population.

- Integrated maps of economic, social and environmental vulnerability have been repeatedly mentioned as a short-term priority. Since collaboration between countries should be the rule, common criteria should be used to allow comparison across countries and regions. The need for more and better quality data on weather, soil and water, demographics, and economic impacts has been continuously highlighted. Referential criteria to determine vulnerability have been discussed and presented in this report.

- Sector specific research on agriculture, health, fisheries, tourism and urban areas has been highlighted as a priority. In addition, four key cross-cutting issues for all sub-regions have been identified: food security, water management, ecosystem resilience, and governance.

- Finally, a new methodological approach to research needs to be adopted. Beneficiaries and decision-makers need to be included right from the outset of the process if results are expected to be useful to any of them. Also, considering the complexity of the climate change phenomenon, an interdisciplinary approach is considered a must in all research initiatives. Special efforts need to be made to strengthen the capacity of professionals from some fields that do not yet have a consolidated presence in the climate change debates, such as economists. A very useful tool to map information needs for policy-makers, produced by Mesoamerican participants, is featured on page 42.

Findings suggest that bottlenecks in dissemination, access to, and use of information in LAC pose a serious risk to an investment in a new research program. Researchers in the Region have produced relevant information that, if properly used, could guide governments, the private sector and local communities in their path towards adaptation. Yet, this has not happened so far. IDRC and DFID need to take current bottlenecks into account if their investment in production of additional information is expected to have any returns in terms of results. Accordingly, these constraints should not be treated as peripheral to the science and development but should be one of the targets of global change research.

Current available information indicates that existing research capacities in the Region are sufficient to support new international research initiatives but need to be strengthened if they are to fill the knowledge and information gaps outlined above. The process has identified potential institutional partners that could help DFID and IDRC with their research initiatives on climate change and who could even strengthen capacities of other potential future partners.

Interestingly, the voices of interviewed members of vulnerable communities and those of the participants who attended the multisectorial workshops are quite aligned and certainly not contradictory. Community members do focus their attention on practical adaptation needs but also welcome applied research that can contribute to their understanding of changing weather conditions and the prevention of adverse impacts. However, their sense of urgency to tackle problems is different from academic researchers, who usually think in longer time-frames.

Information needs:	
a)	All rural and some urban communities have expressed the need for local climate change scenarios and early warning and prevention systems. These could be operated by them, with good quality meteorological information on winds, rain, tides, submarine currents, sea-level, etc. Information on projected impacts on water availability, agriculture, and infrastructure is highly valued.
b)	Communities would welcome formal and informal education initiatives that can effectively inform both civil society and public authorities about causes and impacts. This could be done using simple and friendly language, as a step towards obtaining true commitment to respond. Capacity building to design their own adaptation strategies is very important.
Practical adaptation needs:	
c)	Alternative farming methods, both in agriculture and fisheries, which can better adjust to climate variations, are being sought.
d)	As increased droughts are an expected part of the climate change phenomenon, agricultural communities need to enhance their capacities for watershed management, with specific interest in efficient irrigation, and rainwater management.
e)	Rural communities request support to design alternative livelihoods, find new sources of income, or create jobs at a larger scale.
f)	Some members of vulnerable communities have resorted to migration as a spontaneous adaptation mechanism. Government planned relocations are seen as an option both by some rural and urban communities.
g)	There seems to be an important wealth of traditional knowledge which, if harnessed, could potentially be useful to improve resilience and adaptive capacity of the population and productive systems.
h)	An increasing concern about the upsurge of new, or long-gone, diseases has led to demands for immunization to and prevention of diseases brought by heavy rainfalls and flooding.
i)	Alternative energy programs and house building techniques to resist colder or warmer temperatures have also been recurrently mentioned as needs.
Institutional capacity needs:	
j)	Communities value territorial, land-use and contingency plans as the right tools for decision-making. Yet, they have expressed serious concerns regarding insufficient planning capacities in state institutions and limited opportunities for multi-stakeholder participation with a bottom-up approach.
k)	Most importantly, communities value social cohesion and organizational development as a key asset to successful adaptation. They believe in information networks and community team-building and state that various stakeholders from different fields need to come together.

It should be noted that some of the needs expressed by vulnerable communities aim at very concrete actions, such as infrastructure development or irrigation projects. These, certainly, should be primarily addressed by public or private investment. A research program could only bring in some knowledge on some aspects of these needs.

The commissioned experts' review of a draft version of this report indicates that the key findings of the consultation process are consistent with most of the existing knowledge found in literature.

Overall, the consultation process has resulted in a comprehensive formulation of stakeholder concerns in the region, which now needs to be combined with some of the scientific evidence and especially with institutional responses, to chart future actions on adaptation to climate change.

FFLA recommends that IDRC and DFID do not adopt a geographic focus for their new climate change initiatives. Rather, FFLA believes that priority should be given to research with high replication potential, namely research on sectors and cross-cutting issues of common concern to all sub-regions (please, see section 3.1.1 e. and f) and research initiatives to downscale climate scenarios, map vulnerabilities, and assess costs of climate change impacts and adaptation. New international efforts should be concentrated on research proposals that can demonstrate early engagement of communities and/or decision-makers in the research process and that are submitted by an inter-disciplinary group of researchers.

While representatives from different Brazilian organizations actively participated in the Southern Cone and the Andean Sub-regional consultations, unfortunately, the consultation process was not able to fully assess the research needs of Brazilian stakeholders and it is suggested that this gap be filled through a specific country consultation.

It should also be noted that the consultation process was not able to incorporate the views of the energy sector, considered key by almost all participants. FFLA recommends an additional consultation is conducted to obtain this important information.

Finally, FFLA would like to suggest that IDRC and DFID consider putting together an Advisory Board for their Programs. This Board could be integrated with recognized members of vulnerable communities and sectors, researchers, governments, and local authorities, linked to the research projects. Annual meetings could be held to assess impact of the Program and provide ideas for further research. Following up with recommendations made by participants, it would be convenient to include young people in the Advisory Board as well.

Accordingly, a knowledge management mechanism that would allow for early systematization of tools and methodologies developed by projects under the Program should be put in place to aim at obtaining comparable results and replicating successful experiences.

Summary Table: *Research Issues, High Vulnerability Areas & Stakeholders*

	Common issue areas for research:
1	Economic impact of climate change and costs associated to adaptation options
	Downscaling climate change scenarios
	Early warning systems
	Vulnerability Maps
2	Food security
	Agriculture (in general) and, specifically: new types of crops; diversification; improved irrigation; policy incentives
	Fisheries (in general) and, specifically: sustainable fisheries management; changes in marine currents; alternative ways of producing seafood.
3	Water management (in general) and, specifically: policies and techniques for efficient use; rainfall water management; supply vs. demand analysis; micro watershed management; salt-water intrusion
	Ecosystem resilience
4	Health: correlation between climate change and the spread of vector-borne and other diseases
5	Alternative energy programs
6	Tourism
7	House building techniques to resist colder or warmer temperatures
8	Governance: new institutional arrangements for decision-making on climate change
	Harnessing traditional knowledge to cope with climate change

Areas of high vulnerability:	
Caribbean	
1	Dominican Republic and Haiti, especially hillside farmers
2	Coastal areas island states (storm surges, high waves, highly urbanized so more prone to water deficits), especially Jamaica
3	Low lying flood prone areas in the Caribbean (E.g. Guyana and Grenada)
4	Small islands without economies of scale (E.g. Grenada)
5	Coral reef habitats (major coral bleaching event as recent as 2005 in Barbados, but many examples across the Caribbean).
Andean Region	
1	Flood-prone zones, such as most coastal areas of Peru, Ecuador, Venezuela and Colombia.
2	The "llanos" of the Orinoco River (Venezuela and Colombia)
3	The highlands of Peru (Cusco), Ecuador, Colombia (Chingaza), and Venezuela (between cloud forest and "páramos"). Special emphasis needs to be placed on glacier retreat processes and "páramo" (high altitude moorland) degradation.
4	Large marginal zones of big cities, with specific focus on population without access to water and sanitation
Mesoamerica	
1	The dry Mesoamerican corridor
2	Urban areas with population lacking access to water and sanitation, and building their homes in risk-prone areas (E.g. Metropolitan areas of the cities of México, such as, Monterrey, Guadalajara, and Ciudad Juárez)
Southern Cone	
1	Subsistence agricultural areas
2	Urban areas with population lacking access to water and sanitation, and building their homes in risk areas
3	Hydroelectric sector
Key stakeholders for the research program to engage with:	
1	Municipal and regional governments, carefully identifying public officials with decision-making power
2	Regional organizations such as the Andean Community (CAN), Mercosur, CARICOM, and SICA
3	Community-based organization located in vulnerability hotspots
4	Scientific and educational research institutions, particularly those with interdisciplinary programs
5	Private sector organizations, particularly those that may be negatively affected by climate change, in an attempt to involve them in supporting further research efforts
6	National and international NGOs, and youth organizations

1

Background and Objectives of Consultation Process

As the Intergovernmental Panel on Climate Change (IPCC) has concluded in its recent assessments, development and climate change are intimately connected. Present and anticipated impacts arising from climate change do and will continue to affect current development plans. Similarly, wise development planning and decision-making can help address the threat of climate change.

The International Development Research Center (IDRC) and the Department for International Development of the United Kingdom (DFID), as leaders in funding research to support development, have a commitment to strengthen the capacity of developing countries to assess and address the threat that climate change puts on development and poverty alleviation. Both institutions initiated a consultation process to inform their research programs to effectively assist countries in Latin America and the Caribbean (LAC) and Asia in tackling climate change. The potential impact of these programs will be maximized if they accurately address the real needs of the most vulnerable populations and if they are able to build upon current adaptation and mitigation efforts undertaken by Asian, Latin American and Caribbean societies.

In LAC, during the past ten years, government action related to climate change has been mostly focused on mitigation efforts, motivated by funding under the United Nations Framework Convention on Climate Change (UNFCCC), while attention to adaptation has been scarce. There are, however, some signs of change. For example, the recent Declaration of the 5th summit of LAC Countries and the European Union, held in Lima on May 16th 2008, addressed equally both adaptation and mitigation. The Presidential Summit of Central America and the Caribbean on Climate Change and the Environment, held in Honduras in May 2008, outlined a research agenda. The Andean Community has produced a preliminary report on potential economic impacts of climate change[1], in a clear attempt to draw the attention of its member governments towards the need for a stronger focus on adaptation. Mexico is taking steps towards producing a document similar to the Stern Review Report, which could guide its policy on climate change.

Reducing emissions from deforestation and degradation (REDD), also called avoided deforestation, has captured the attention of many of the LAC countries since deforestation accounts for a total of approximately 20% of the world's emissions of GHG and because it was not included as an option in the Kyoto Framework. There are two main points of disagreement among the countries in the region. First, whether REDD should be supported by a fund created by taxing the rest of the carbon market and contributions from the developed countries, or whether REDD should be supported by a market for Forest Carbon Credits. Second, whether accounting for reductions in deforestation should be measured against a national baseline (or reference scenario, as it is being called) or against some kind of a sub-national metric. Among the most active countries in the region are Costa Rica, Panama, Mexico, Bolivia, and Brazil. Others, like Peru, Colombia, Argentina, and Ecuador are expressing interest and presenting ideas as well.

In this context, to conduct its consultation process, IDRC and DFID have relied on Fundación Futuro Latinoamericano (FFLA – www.ffla.net), a non-profit organization based in Quito, Ecuador, committed to promoting constructive dialogue, to capacity building, and stakeholder engagement for sustainable development.

The main objective of the process has been to assess, through a process of regional consultations, the knowledge requirements of relevant stakeholders and the state of existing capacity and needs of the most vulnerable populations to cope with the impacts of climate change in LAC.

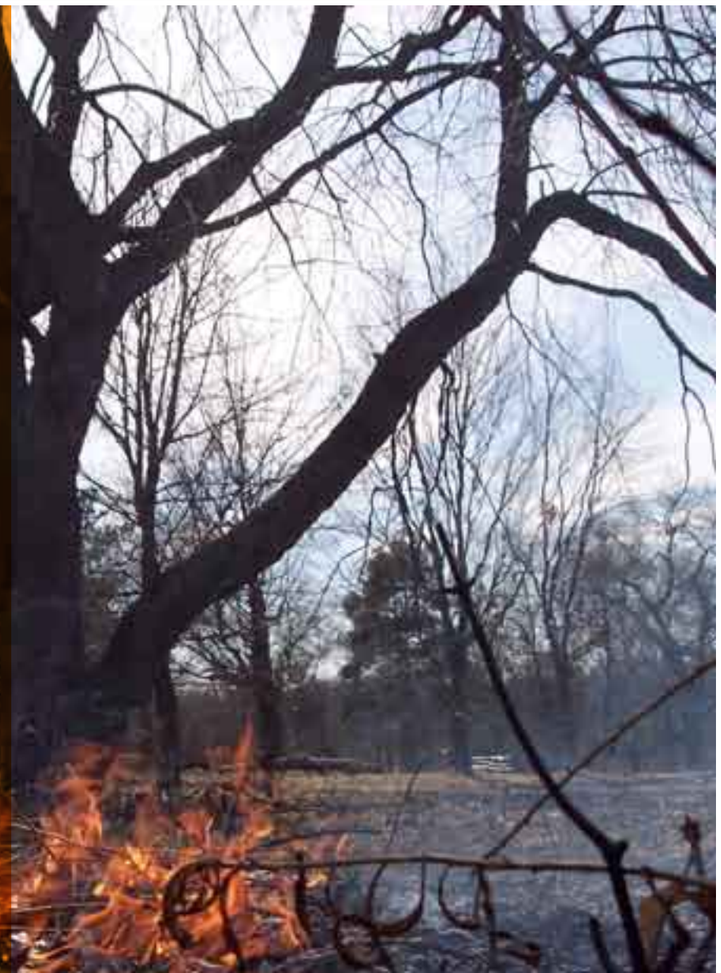
Specifically, the project sought to:

- Understand local, national, and regional priorities, identify the major knowledge gaps and information needs as recognized by a range of stakeholders (including vulnerable communities), as well as the constraints to make optimal use of existing and new knowledge and of known good practices;
- Assess the current status of regional, national and local research capacities, and ongoing and planned climate change research initiatives;
- Identify some of the leaders considered to be the main "agents of change" (social entrepreneurs), and assess their knowledge and information needs;
- Build ownership and involvement of key communities in program definition.

1 *Secretaría General de la Comunidad Andina, "El Cambio Climático no tiene fronteras. Impacto del Cambio Climático en la Comunidad Andina." http://www.comunidadandina.org/public/libro_84.htm Mayo, 2008.*

2

Approach and Methodology



Based on experience in previous consultations and policy dialogues conducted by FFLA, dialogue amongst different sectors offers a good opportunity to exchange information and allow for cross-fertilization and integration of ideas, proposals and strengths. Understanding of the others' needs and views leads to integrated agendas supported by different sectors. This rationale led IDRC, DFID and FFLA to opt for a geographic – rather than sectorial – focus to organize the process. The project took off in November 2007. FFLA designed a methodology that would allow a maximum number of stake-holders to contribute to the process in a very limited period of time – 3 months.

The Cropper Foundation in Trinidad & Tobago in the Caribbean[2], the Latin-American Centre for Competitiveness and Sustainable Development (CLACDS) of the INCAE Business School in Costa Rica[3], and RIDES (Resources and Research for Sustainable Development)[4] in Chile were invited as partners to undertake sub-regional consultations in the Caribbean, Mesoamerica and the Southern Cone respectively, considering their previous experience in climate change issues and their capacity to convene a wide array of stakeholders. Hereinafter, they will be referred to as "partner organizations". FFLA was responsible for conducting the process in the Andean region.

Procedures, timelines, scope, tools, and expectations were discussed and agreed upon during an inception meeting in Quito (November 14-15, 2007). Main stakeholders to be consulted were defined: government, private sector, research institutions, and NGOs. Each consultation was programmed to bring different perspectives and experiences to the meeting. Academics and practitioners were expected to share information from their countries and fields of expertise, as well as offer local, national and regional visions. The group agreed to approach a few specific vulnerable communities to inquire about main concerns and responses to climate change. Finally, the group also agreed to identify and list existing bibliography on climate change issues produced by international, national and local organizations in each sub-region.

Unfortunately, the consultation process was not able to assess the research needs of Brazilian stakeholders. While representatives from different Brazilian organizations actively participated in the Southern Cone and the Andean Sub-regional consultations, it became clear that a specific consultation needed to be held in Brazil. A strategy was outlined to breach this gap but there was not enough time to adequately coordinate efforts with the Brazilian Government. Although additional information was gathered by consultants at the National Environmental Conference held on May 7th- 11th, 2008 (please see Annex III for the consultants' report), it should be noted that a thorough assessment on Brazil's research needs is recommended.

2.1 Commissioned regional and sub-regional overview papers

In order to provide participants with updated quality information to catalyze the discussions, IDRC, FFLA and DFID asked Cecilia Conde[5] to prepare a 10-page document (please see Annex I) in which she would summarize her views on the main challenges faced regarding climate change.

According to Ms. Conde, during the last decades, important changes in rainfall and significant temperature and acidity increases have been reported in LAC. Additionally, changes in land use have exacerbated land degradation. Projected sea-level rise, climate variability and extreme events are likely to affect coastal zones. By 2020, depending on the scenarios, between 7 and 77 million people will suffer from severe water scarcity due to climate change. By 2050, it is probable that in the east of the Amazon Region, tropical forests are replaced by savannah biomes. Other projections indicate that in dry areas (centre and northern Chile; Peruvian coast; North-eastern Brazil; Dry Chaco; Cuyo; centre, west and north of Argentina; and large areas of Mesoamerica), climate change may lead to salination and desertification of croplands. Also, an increase in the temperature of the oceans will have negative effects on coral reefs and regional fisheries. Many species in tropical areas in Latin America face significant risk of extinction, amphibians from the rainforest being a clear example, and subtropical ecosystems also are or will be affected by climate change.

Ms. Conde strongly advocates for research and policy focus on adaptation and vulnerability, considering that LAC only contributes 3.5% of the world's emissions of GHG per capita (IPCC 2007), most of which comes from deforestation. While she acknowledges the efforts of many countries to adapt to climate change -mainly through

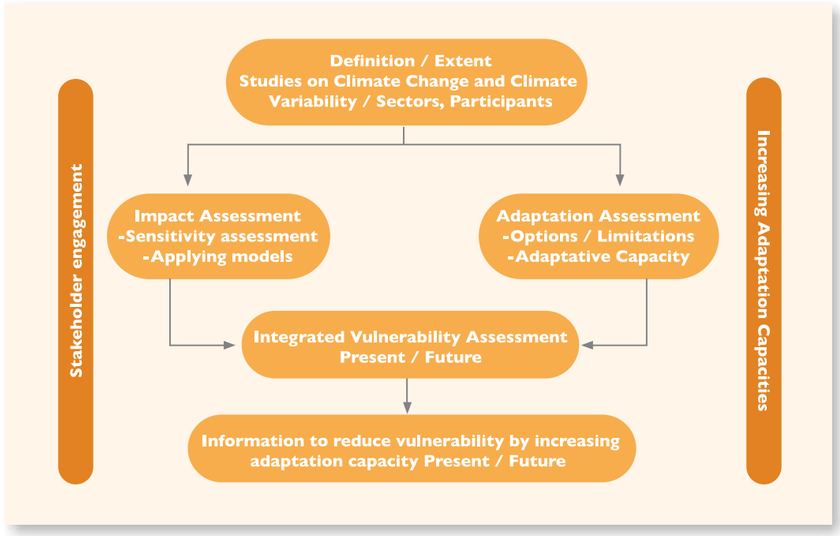
2 http://www.thecropperfoundation.org/
3 http://www.incae.ac.cr/ES/clacds/que-es/
4 http://www.rides.cl/
5 *Ms. Conde, PhD in Earth Science, is a specialist in atmospheric physics at the National Autonomous University of Mexico (UNAM). She is responsible for research related to climate variability and climate change impacts on Mexican agriculture, and co-responsible for scenarios published in the Third National Communication. Also, she is the main author of the following chapters of the IPCC's Assessment: Chapter 2 "New methods of assessment and characterization of future conditions" and Chapter 17 "Assessment of adaptation capabilities, barriers, options and practices".*

conservation of ecosystems and through early warning systems and strategies to cope with drought and floods- she outlines some of the main challenges that the region faces to facilitate effective adaptation:

1) Weaknesses in projects and policies related to climate change, including uncertainties in the models, scenarios and projections, and especially regarding communication of risk to stakeholders;
2) Little inter and multi-disciplinary research;
3) Limitations to face present climate trends and variability;
4) Lack and/or weakness of trustworthy observation systems;
5) Weakness in monitoring systems;
6) No investment and credit for infrastructure development in rural areas;
7) Low technical capacity;
8) Scarce integrated –especially cross-sectorial- assessments;
9) Scarce studies on economic impacts of climate change.

Ms. Conde suggests that research on vulnerability and adaptation should follow the path outlined in the figure below, engaging all stakeholders from the very definition of the projects, strengthening capacities during the process, considering historical climate variability and practices of adaptation. This would be the right way to integrate "down-scaling" climate studies with "up-scaling" economic and social studies.

Figure 1. *Description of the method followed by new climate change studies (Lim, et al, 2005)*



Finally, Conde points out that we are all working in a context of uncertainty, where some decision-makers are risk-averse and others are risk-lovers. She asks herself what the appropriate instruments are to assess uncertainty so as to choose either to act or to suffer the costs of inaction.

The differences in LAC's geography and conditions led FFLA to commission specific papers to well-known regional experts in order to ensure adequate focus on sub-region-specific issues, threats, concerns and priorities during the consultation meetings. Main findings from each consultation are illustrated in Section 3 with data presented in these sub-regional papers.

All of these documents and their corresponding PowerPoint presentations were distributed to participants and are available in their original languages[6]. These papers and presentations leveled the degree of information necessary to start deliberations amongst individuals from different sectors and backgrounds, and forced the group to concentrate on key questions: what is known, what needs a better understanding and what priorities are perceived as fundamental to better respond to change. Another advantage of the base documents was their graphic and summarized presentations. Experts in the region concentrated important information in simple language, with charts and diagrams that were easy to understand by scientists and practitioners. Participants valued this contribution as useful for their meeting and subsequent work. They requested electronic copies and authorization to use them in their own institutions. The rating of the regional and sub-regional presentations was amongst the highest in the individual evaluation questionnaires all participants were requested to provide.

6. *The sub-regional papers and PowerPoint presentations can be found in the following link http://www.ffla.net/index.php?option=com_content&task=view&id=242&Itemid=150*

2.2 Multi-sector consultations

Four multi-sector sub-regional consultations, involving key actors from the most important sectors, were held during the first quarter of 2008, convening approximately 130 experts from different countries with recognized experience and knowledge in the field. Care was taken to convene participants aiming at an adequate balance between countries, sectors, and gender. Participants were selected based on recommendations made by FFLA and sub-regional partner organizations, suggestions by IDRC and DFID, recommendations from other participants, and leadership in the IPCC process. (see table 1).

All sub-regional consultations were designed following the same agenda and were structured as workshops. Participants belonged to different sectors, including government, science, academia, NGOs, private sector, and international organizations. Professional facilitators who had designed the agenda in advance conducted all meetings. Lessons learned from initial consultations were rapidly applied to the following workshops, thus improving quality and efficiency.

Each of the consultations began with introductory presentations on scenarios, impacts, response mechanisms, and challenges related to climate change in the Region by Cecilia Conde and the corresponding sub-regional expert: Ulrich Trotz in the Caribbean, Rene Castro in Mesoamerica, Adriana Soto in the Andean Region. Unfortunately, the expert who was commissioned for the Southern Cone did not produce a paper and only produced a PowerPoint presentation for the meeting.

Important discussions took place after the technical presentations. Participants complemented information with their own personal experiences and debated over realities and perceptions in their own context. Next, participants were split into 3 to 5 working groups, guided by structured questions to identify: a) main gaps and needs in research and knowledge on climate change in LAC; b) local communities vulnerable to climate change and tools to determine vulnerability; c) key actors and research capacities and initiatives. The conclusions of each group were presented in plenary sessions where further dialogue was promoted and doubts were clarified. Facilitators would then work on a new document that would summarize key recommendations. Finally, this summary was presented to the participants for their consideration and, once agreement was reached, an additional effort was made to define priorities where possible.

A document summarizing the results from each sub-regional consultation was prepared by the coordinating institution and is available for distribution among interested partners and institutions in the sub-region in the language used for the sub-regional processes (English for the Caribbean and Spanish for the other sub-regions)[7].

On May 15-16th, the project convened the final multi-sectorial meeting in Quito. Its purpose was to validate the results of the sub-regional consultations. During the first day, based on a summary of previous discussions, participants were asked to agree on a set of criteria that could be used to define "vulnerability" and to give examples on specific locations from their sub-regions that would meet the outlined criteria. On the second day, participants were asked to deepen the analysis on the different research needs that were prioritized during sub-regional consultations. The report of this meeting is presented separately in FFLA's webpage[8].

7. *http://www.ffla.net/index.php?option=com_content&task=view&id=242&Itemid=150*
8. *http://www.ffla.net/index.php?option=com_content&task=view&id=242&Itemid=150*

Table 1. *Regional Consultations*

Regional Consultation	Country and Date
Caribbean	
Participants: 25 experts from Barbados; Belize; Guyana; Jamaica; Trinidad and Tobago; San Vicente, Grenadines; and St. Lucia.	Trinidad, January 24-25th, 2008 Coordinated by the Cropper Foundation
Southern Cone Region	
Participants: 50 experts from Argentina; Southern Brazil; Chile; Paraguay; Uruguay.	Chile, January 28-29th, 2008 Coordinated by RIDES
Andean Region	
Participants: 34 experts from Bolivia; Northern Brazil; Colombia; Ecuador; Peru and Venezuela.	Ecuador, February 14-15th, 2008 Coordinated by FFLA
Mesoamerican Region	
Participants: 22 experts from Costa Rica; Guatemala; Honduras; México; Nicaragua; Panama; Dominican Republic; Salvador.	Costa Rica, February 27-28th, 2008 Coordinated by INCAE

A complete list of participants and contact information is provided in Annex II.

2.3 Consultation with vulnerable communities

Paraphrasing a recent article by Mr. Saleemul Huq (2008), the early studies into the impacts of climate change used global circulation models in a top-down manner to predict scenarios in different places. Based on these results, the next phase of research used a more bottom-up approach to identify the places, activities, and communities most at risk. These, in turn, led to a third generation of studies that used both sets of information to develop plans for how those affected can best prepare and adapt. None of these studies has yet progressed beyond carrying out theoretical analysis and did not bring concrete results to the communities who needed to adapt rapidly to climate change. The next generation of research must be linked actively to the people whose lives will be most affected, and researchers must learn from doing. They must continually involve the people who will use their research results in all steps of the process, from designing a project to implementing it and communicating its findings. Those users will include national policy-makers and planners, responsible for adapting the water and agriculture sectors or preparing coastal areas for more frequent and more severe flooding as the sea level rises. They also include local governments, aid workers, and non-governmental organizations who are working on adaptation at the community level. Researchers need to seek out the organizations and individuals most in need of the information they can provide, and then engage with them in designing their research agendas. Without the input of these users their research will be largely meaningless.

It should not be assumed that all that is needed is more detailed climate impact models. Climate data and fine-scaled models are useful in the more developed countries, but in most developing countries and most certainly in the poorest countries and communities little data will be available. As a result, computer modeling will be of limited value when planning adaptation strategies in the near term. And while technology transfer is important for climate change mitigation, what must be shared for adaptation is knowledge and experience.

In order to give further emphasis to the needs of these groups, and to include them from the outset in the very definition of a potential research program, it was considered important to identify and collect information about adaptation needs of vulnerable communities to climate change in the region, by means of complementary interviews to knowledgeable local people.

In this context, all partner organizations were requested to identify and select between 10 and 12 communities vulnerable to climate change in their sub-region. Key actors would be interviewed to understand their main perceptions in relation to the vulnerability level that certain sectors have to climate change, as well as the possible efforts in prevention, mitigation, adaptation, degree, and role of scientific intervention. Similarly, they were asked about local community involvement and preparation towards the more urgent activities and measures necessary to effectively face the impacts of climate change.

The team was aware that defining vulnerability is a contentious issue and, most probably, one that should be part of a research program. However, considering the importance of gathering the perception of potentially vulnerable actors, communities to be interviewed were selected based on the following criteria, outlined in the initial coordination meeting and later detailed in sub-regional consultations:

a) High climate variability (cold, heat, rainfall or droughts) threatening productive processes that are important for the local and national economy, food safety of the poorest populations, or people's lives;
b) Rural and urban areas;
c) Low adaptive capability to confront climate change due to poverty and/or lack of adequate infrastructure; and,
d) Representation of different ecosystems such as mountain and high lands, coastal, low lands or islands, where threats of glacier retreat, sea level rise or floods can be perceived.

Consultation in the communities was assigned to experts with experience in social research and knowledge of the community. The organizations in charge of this activity in each sub-region were: The Panos Institute *(http://www.panosinst.org/)* for the Caribbean sub-region, RIDES for the Southern Cone sub-region, FFLA for the Andean sub-region, and INCAE-CLACDS for the Mesoamerica sub-region.

The following charts present the vulnerable communities interviewed in each sub-region and includes a brief description of the potential threats they are exposed to:

Table 2. *Vulnerable communities selected for consultation*

THE CARRIBBEAN		
COUNTRY	**COMMUNITY**	**SELECTION CRITERIA**
Haiti	Carrefour - Mariani (Formerly rural community on outskirts of Port-au-Prince, between the base of a high mountain and the coast) (30.000 people)	Haiti (27,500 km2) has a very long coastline (1,771 km) and is bordered by the Atlantic Ocean in the North, by the Caribbean Sea in the South and in the West by the shallow Gulf of Gonâve. The population is close to 8 million, according to the census of 2003, centralized in the metropolitan area of Port-au-Prince (56% of the urban population). The size of the rural population has decreased systematically, from 87.8 % in 1950 (chart of poverty version 2004) to 59.6% in 2003. People have gone to the urban environment (often slums) because of increasing poverty and misery in rural areas. Less than 40% of the inhabitants of Port-au-Prince have access to running water and this ratio is probably similar in the secondary cities. Running water is contaminated by infectious micro-organisms, causing numerous children to die, in particular those which are underfed. The majority of families, made up of at least 6 people, live in one room. Spontaneous construction takes place everywhere and the weaknesses of public institutions as well as the absence of a land register make it very difficult for rightful owners to protect their properties. Moreover, the large transient population causes much "temporary settlement". The Haitian productive economy still rests on subsistence agriculture, often practiced on steep sloping terrain and therefore very vulnerable to climate risks. However, more and more subsistence farmers have abandoned their fully degraded lands. Gross Domestic Product (GDP) is estimated at US$250 and extreme poverty is widespread. There is enormous unemployment (>70%). Haiti has suffered many natural disasters over recent years, much due to the overall level of environmental degradation in the country, as well as unplanned development. The country is severely vulnerable to rain torrents, tropical storms, hurricanes, and sea-level rise, causing floods and landslides. Risks identified are: a) loss of human lives, b) exacerbation of problems to access drinking water and sanitation services, c) infrastructure damage, and d) health problems.
	Gonaives (Low-lying coastal port city, at the mouth of a long valley where several water catch areas come together) (280.000 people)	
	Marigot (Coastal city at the base of high mountain range) (58.000)	
	Miragoane (Port-city on the Southern peninsula, with a large and deep pond) (40.000)	
	Thiotte (Isolated rural mountain community) (23.500)	
	Philipeau (On the foot slope of a large mountain which oversees Port-au-Prince and Petionville) (20.000)	
	Fonds – Verrettes (Low-lying inland community between mountain ranges, on the border of the D.R.) (45.000)	
Jamaica	Mocho (Inland rural mountainous farming community, mined for bauxite for over 30 years) (6.000)	Coastal inundation, sea level rise, increasingly unpredictable weather patterns, and damage by extreme events are among the chief concerns for Jamaica. Hurricane Ivan in 2004 dumped nearly 2 meters of sand along the entire roadway leading to the Norman Manley International Airport (NMIA), and rendered it impassable for nearly one week. The hurricane also disrupted the shoreline along the eastern end of the runway. Should there be a major climate disaster, overseas aid may have to be shipped rather than airlifted, since both airports could be inundated. The central business districts, key infrastructure, and major tourist accommodation and attractions are all in the coastal zone. In many cases, relocation or abandonment are not realistic options. Coastal flooding occurs with heavy rainfall associated with tropical cyclones and imposes serious inconveniences and loss of revenue. Sea level rise bears significant concerns for saline intrusion into the country's ground water. Estimates are that up to 80% of the island's freshwater is supplied by ground water. Loss of revenue could also result as the country supplies water to a number of cruise ships that dock in its harbors. Communities selected for this consultation were badly affected by massive waves generated by Hurricane Ivan in September 2004. These communities make their living mostly by fishing and small scale agriculture.
	Portland Cottage (Rural Coastal Community) (10.000)	

THE CARRIBBEAN		
COUNTRY	**COMMUNITY**	**SELECTION CRITERIA**
Dominican Republic	El Duey – Villa Altagracia (Inland community of houses constructed in a valley in a protected area)	The Dominican Republic is a mountainous country. Sixty percent of the land area is on slopes and 40% is on valleys and lowland. There is sufficient statistical evidence of change in dry and rainy seasons in the Dominican Republic and it is expected that the impacts of drought will increase in coming decades. The more arid parts of the country (about 18% of the country is barren or semi-arid), are now characterized by a negative hydric balance for almost the entire year. All numbers indicate that in 50 years the maximum rain intensity has increased with 40%. Tropical storms, such as Noel (October 2007), are an example of what is to come, causing flooding in 80% of the country, collapsing the water supply system and blocking access to the southern region of the country. At least 12 communities became inaccessible, there were more than 80,000 people displaced; 85 dead and 48 missing; and more than 20,000 dwellings damaged. Main risks identified: a) damages to housing and road infrastructure; b) loss of human lives; c) serious impacts on agriculture; d) health problems associated with climate change (E.g. influenza).
	Jaquimeyes (Low-lying rural community between a major river and the coast)	

SOUTHERN CONE		
COUNTRY	**COMMUNITY**	**SELECTION CRITERIA**
Chile	Río Hurtado	The community of Río Hurtado, located 450 km north of Santiago, is highly vulnerable to climate change since its economy heavily depends on a very precarious ecosystem, affected by land degradation and long drought periods. Almost 62% of the land is undergoing serious desertification processes due to forest clearance on mountain slopes and modern cattle-raising techniques. Population is mostly poor living on a subsistence economy (mostly cattle and fruit) that generates seasonal income when production is sold to national markets. The main risk associated to climate change is water shortage, due to longer droughts and higher temperatures. This is affecting not only economic activities but also education (2 schools have been closed), health (spread of contagious diseases), and social capital (migration).
Argentina	Moreno	The township of Moreno, located 37km west from the city of Buenos Aires, is one of the poorest of the Metropolitan area (26% of the population is poor). Numerous shanty houses are built in flood-prone areas without access to basic water and sanitation services. Heavy rainfalls, strong winds, cold and heat waves are happening recurrently. Floods do not usually last long but appear to be more frequent. The main risks identified are: a) loss of housing infrastructure due to floods and weak enforcement of urban planning, and b) the calendar of diseases is changing and summer illnesses are present also during winter.
Paraguay	Isla Umbú	The community of Isla Umbú is small town in southern Paraguay where 320 people make a living from agriculture (corn, cotton, vegetables) and cattle-raising (mainly for milk production). The area has been exposed to changes in seasons and rainfall patterns. Droughts last longer and rain is more intense, causing non-cyclical floods. Main risks identified are: a) damage to housing, roads and communication infrastructure, b) loss of productivity caused by proliferation of plagues, droughts ("tajamares", artisanal water reservoirs, are dry in summer), frost, high temperatures, and stronger winds; c) social problems -such as family disintegration, diseases, education- are exacerbated.

ANDES

COUNTRY	COMMUNITIES	SELECTION CRITERIA
Ecuador	Quijos Communities: Quijos, El Tambo, Cosanga	The "páramo" ecosystem in the Valley of Quijos provides most of the water for the Province of Napo, in the Amazon Region, and for the City of Quito and its surroundings as well. It is an important commercial corridor between the "Sierra" and the Amazon Regions. Main risks identified are: a) damages to roads due to intense rainfall have caused loss of lives, interruption in trade flows, food shortage, reduction in tourism, and problems with energy supply; b) reduction in agricultural and cattle-raising productivity, due to heavier rainfalls and longer droughts; c) water supply for Quito is threatened due to degradation in "páramo" ecosystem caused by the expansion of agricultural border into the "páramos", temperature increase, and reduction in rainfall; and d) an increase in respiratory diseases, associated with higher frequency and intensity of climate events. The capacity of these communities to adapt to climate change impact is low. Approximately, 48% of its population is poor and young people migrate to Quito for job opportunities.
	Santa Elena Communities: Santa Elena, Palmar, San Pablo, Montañita, Olón, Manantial, Puerto Chanduy, El Real, Valdivia)	The Santa Elena Peninsula is located on the Ecuadorian Coast, 120 km east of Guayaquil City and hosts steep mountains, cliffs, dry tropical forests, large plains, and long beaches. The most important economic activities are fishing, agriculture, cattle-raising, and tourism. Almost 83% of the population is poor. Main risks identified are: a) reduction in fishing productivity, attributed to an increase in the temperature of the sea and to stronger winds (also, fuel costs make it difficult to navigate long distances; b) low agricultural productivity, caused by longer dry seasons and an increase in temperature, affecting water availability for irrigation; c) damages to housing and road infrastructure, vulnerable to strong winds and heavy rainfall, affecting tourism and food supply; d) proliferation of diseases such as dengue, malaria, fever; e) loss of human lives due to flooding.
Peru	Lima	Lima is the capital city of Peru and hosts almost a third of the Peruvian population. It is the main center of the economy of the country. Leading activities are services and manufacturing. In the outskirts of Lima, agriculture and cattle-raising activities are led by local poor communities. The main risk posed by climate change is an exacerbation of trends towards severe water shortage in the coming 10 to 20 years. Desertification has reduced water flows in the Mantaro River and pollution from mining and expansion of the agricultural border are also affecting its capacity to provide safe drinking water.
	Cusco Communities: Cusco, Yaurisque, Itunca	Located at 3.339 meters above sea level, Cusco is an important economic and cultural center. While tourism is a key economic activity, large-scale copper mining and agriculture (tea, coffee, cocoa, potato and soya) significantly contribute to local income. Main risks identified are: a) impacts on agricultural productivity due to changes in temperature and rainfall patterns (certain areas have become significantly colder); b) stronger and more frequent diseases (diarrhea, fever, respiratory diseases) and emergence of plagues; c) damages in road and housing infrastructure, caused by landslides; d) shortages in water availability, due to glacier retreat, longer dry seasons, and increase in water demand. Since local capacities to adapt are low, there is a tendency to migrate to urban centers.
	Piura	The Province of Piura is located on the northern coast of the country and is crossed by the Piura River, born in the sierra of Huancabamba. The main economic activity is agriculture, mainly cotton. Fishing is important specially to produce fish flour. Only 30% of fish products are destined for human consumption. Tourism is also important. Main risks identified are: a) impacts in agricultural production, caused by events such as droughts and torrential rainfall, and by colder temperatures ("friaje") in the higher lands; b) diseases and plagues (dengue, yellow fever, and malaria) have re-appeared; c) damages to road infrastructure, caused by unusual flooding; d) existing problems in water management (inefficient irrigation, unsustainable water consumption patterns, etc.) will be exacerbated by climate change impacts, causing serious shortage in water supply.

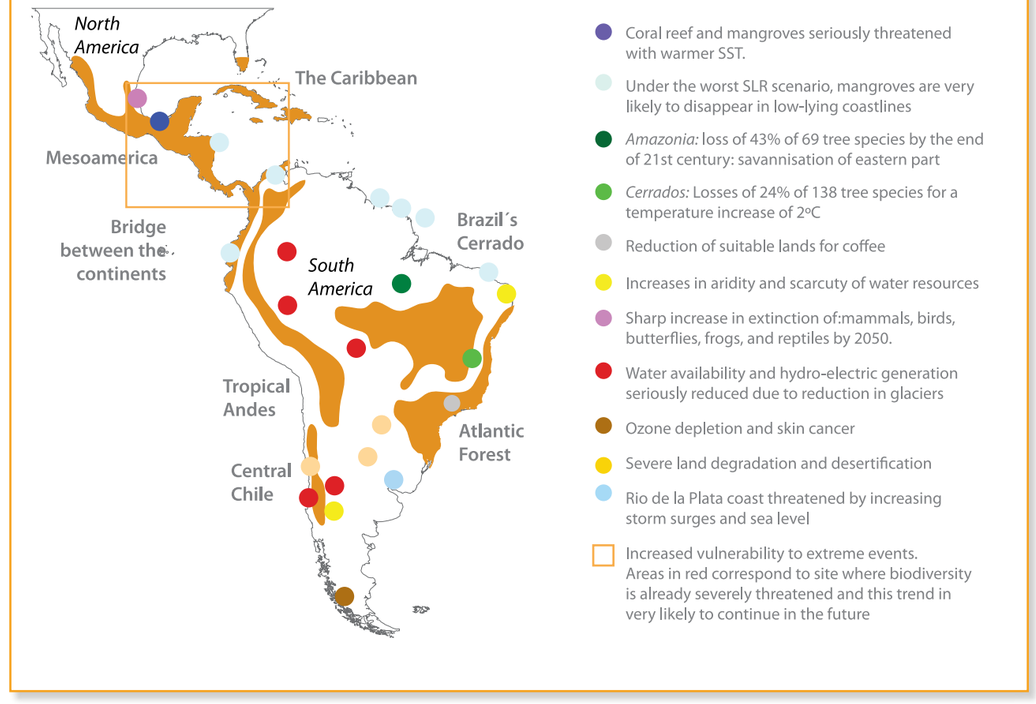
ANDES

COUNTRY	COMMUNITIES	SELECTION CRITERIA
Colombia	Tumaco	The population of this island, located in Southwest Colombia, is mainly poor and depends on trade, agriculture, fishing, forestry, small-scale mining and tourism. Recurring extreme events such as tropical storms, heavy rainfall, hurricanes, and high tides are threatening the area. Main risks identified are: a) potential damage to housing and infrastructure (there is only one bridge that links the island to the continent); b) flooding of over populated areas may result in loss of human lives; c) problems with drinking water supply due to potential decrease in rainfall in the long term combined with deficient water management. The community has little adaptive capacity and many of its members have decided to migrate.
	Santa Marta	The city of Santa Marta (Dept. of Magdalena) is located on the coast of the Caribbean Sea and at the foot of the Sierra Nevada de Santa Marta. It is, not surprisingly, one of the most visited sites of Colombia. Local economy is based on tourism, trade and fishing. It is also the third commercial port in Colombia. Main risks identified are: a) increase in desertification processes and changes in agricultural patterns due to changes in intensity and frequency of rainfall patterns; b) a decrease in water availability and an increase in floods may be caused by the retreat of the Santa Marta Glacier, combined with poor ecosystem management, which provides water to the city and neighboring towns; c) fishing resources are becoming scarcer and may be further affected by marine ecosystem degradation due to sedimentation caused by rivers and to changes in submarine currents; d) potential damages to infrastructure (mainly houses and boats) and to poor populations caused by torrential rainfall and an increase in frequency and intensity of winds; e) potential increase in health problems related to changes in rainfall patterns, and increasing temperatures; f) higher energy costs due to an increase in air-conditioning use. The city does not seem to have good adaptation capacities.
	Barranquilla	The city of Barranquilla is located on the Atlantic Colombian Coast, on the lower banks of the Magdalena River. It is the fourth largest city in Colombia (aprox. 1,695,000 people). It is an industrial center and its economy depends on industry, trade, services, and fishing. Main risks identified are: a) loss of human lives (400.000 people and 8500 houses are located in high-risk areas) and damage to road and housing infrastructure, caused by floods and landslides, due to season change and to an increase in torrential rainfall, combined with deficient sanitation services; b) increase in desertification processes; c) frequent temporary closures of local airport, caused by strong winds; d) reduction of water availability due to sedimentation processes affecting aqueduct systems; e) health problems associated with changes in temperature and rainfall patterns.
	Chingaza	The town of Chingaza is located northeast of the city of Bogotá, in the Andean Region, at 2500 meters above sea level. The weather is relatively cold and the dominant ecosystem is "páramo" (high altitude grasslands). The population depends on agriculture, ranching, and mining. Main risks identified are: a) damages to housing infrastructure and loss of agricultural and cattle-raising production, caused by changes in frequency and intensity of rainfall patterns, winds and frosts (flooding affects subsistence crops and milk production, main sources of income of communities); b) increase in respiratory diseases, attributed to changes in rainfall patterns and to temperature increases; c) reduction of water availability for the city of Bogotá and neighboring towns, with nearly 10 million people (nearly 20% of all Colombian population), due to a combination of human (ecosystem degradation due to burning, deforestation, and polluting practices) and climate factors (reduction in rainfall and increase in temperature). A joint effort by public and private organizations aims at reducing climate change impact on "páramos" and mitigation of socioeconomic risks.

MESOAMERICA		
COUNTRY	**COMMUNITY**	**SELECTION CRITERIA**
Costa Rica	Tarrazú y Alajuelita (San José)	While both communities are located in the same Department, in Central Costa Rica, and have similar indicators of Human Development, Tarrazú has developed a diverse economy, based on coffee plantations and services. Alajuelita, instead, is more of an urban center with belts of people living in poverty. Main risks associated to climate change are related to: a) damage to houses and roads (bridges) due to river flooding and landslides; b) destruction of coffee-plantations due to heavier rainfall patterns and to the emergence of pests; c) water scarcity is affecting construction and tourism.
	Osa (Puntarenas)	Located on the Southern Pacific Coast, Osa is located between mountains and the sea, and is one of the poorest areas of the country. Despite its potential, tourism facilities are not yet developed. Most people depend on small-scale productive activities. Main risks associated to climate change are: a) damage to roads may block access for tourism; b) flooding can affect tourism and housing infrastructure.
	Santa Cruz (Guanacaste)	Santa Cruz is located on the Central Pacific Coast. Its economy is centered on tourism at the beach, usually peaking on week-ends. Climate events affecting the region are droughts, heavy rains, and hurricanes coming from the Caribbean. Main risks associated with climate change are: a) damage to roads may block access for tourism; b) flooding can affect tourism and housing infrastructure.
	Belén (Heredia)	Located in Central Costa Rica, Belen is the production center of the country where 50% of its exports are produced. It is the area with the best Human Development indicators in the country. The main risk associated to climate change is related to damage to houses and roads (bridges) due to river flooding and landslides.
El Salvador	Department of San Salvador. Communities: José Cecilio del Valle; San Pablo (Escalón); Dolores Apulo (Ilopango)	Located in the central area of the country, the selected communities depend mostly on small-scale informal trade and services. Most people need to travel long distances to their work. Main risks associated to climate change are: a) damage to housing and road infrastructure caused by landslides; b) the influence of heavier rainfall patterns over the presence of diseases such as diarrhea and dengue related, as well, to deficient prevention practices. Adaptation capacities seem to be very limited.
	Department of La Libertad. Communities: Puerto La Libertad; Lourdes (Colón), Majahual.	Located in the coastal area of the country, most of the communities depend on artisanal fishing. Main risks associated to climate change are: a) changes in currents and weather patterns affecting productivity of fisheries; b) sea-level rise. Adaptation capacities seem to be very limited.
Nicaragua	Bluefields (RAAS)	Bluefields is located on the Southern Atlantic Coast, at 383 km away from Managua. Both Bluefields and the Corn Islands present a very specific cultural identity where most people speak both Spanish and Creole English. Main risks associated with climate change are: a) water scarcity, associated with deforestation; b) respiratory diseases; c) sea-level rise.
	Waslala (RAAN)	Located 244 km north of Managua, Waslala has a population of 314.000 people. The urban area depends on small-scale trade. Stores are located on the side of the main route that crosses town. The rest of the area is mostly covered by agriculture. Main risks associated with climate change are: a) water scarcity, associated with deforestation; b) respiratory diseases; c) destruction of crops by extreme events.
	Nagarote (León)	The Department of León is located on the Pacific side of Nicaragua with dry-tropical weather. Agriculture has been of economic importance in the area and was affected in 1992 and 1999 by volcanic eruptions. Main risks associated with climate change are: a) changes in weather patterns make it difficult to feed the animals; b) changes in forest habitats.

It is worth noting that most of the communities selected for specific consultations are located in the Key Hotspots for Latin America identified by IPCC Working Group 2.

Figure 2. *Key Hot-Spots for Latin America* [9]



9 *Adapted from IPCC-AR4-WG2*

2.4 Literature review and expert analysis

The main purposes of this component were: a) to identify, catalogue, and describe information about climate change issues related to the sub-region that is available and accessible for research and decision making processes, and b) to assess the main gaps and needs that can be addressed by the research program already mentioned above, thus precluding duplication of research efforts and actions.

INCAE, The Cropper Foundation, FFLA and RIDES have been in charge of literature review in their own sub-regions, and have uploaded both formal and gray literature into the REFWORKS database system. This information will be made available online, in FFLA's website[10].

Finally, considering that the consultation process was oriented to comprehensively raise the concerns of multiple stakeholders, it was pertinent to run its findings by scientific experts who are familiar with the literature generated in LAC, or about LAC, in their respective disciplines and who could point out where there could be gaps between the identified priorities and existing scientific knowledge. Each expert contributed to the review with a specific emphasis or approach and their documents can be found in FFLA's website[11]:

- Jose Marengo: meteorology, climate and hydrology
- Holm Tiessen: agriculture
- Ana Rosa Moreno: health
- Claudia Natenzon: social sciences
- Patricia Romero Lankao: cities
- Avelino Suarez: biodiversity
- Max Campos: water
- Allan Lavell: risk and disaster management

Almost all experts have expressed their satisfaction with the report and have praised the quality and usefulness of the information that has been compiled in such a short time. It was also said that it presents an enormous amount of relevant aspects found from the research, documentation, data and policy angles, which are consistent with current findings and trends in literature. Reviewers have made some general suggestions as well as specific thematic recommendations that have been included, where relevant, in the text of the report.

Vasant Dave

10 http://www.ffla.net/index.php?option=com_content&task=view&id=242&Itemid=150
11 http://www.ffla.net/index.php?option=com_content&task=view&id=242&Itemid=150

3

Key Findings

This section provides an overview of the main results of the consultations process. It starts by summarizing the common priorities and gaps identified in all workshops, followed by a more detailed description of sub-regional outcomes.

It then provides information on risks posed to a potential research program by bottlenecks in dissemination, access to and use of information. Additionally, it describes existing research capacities in the Region.

Finally, it presents findings resulting from specific consultations with vulnerable communities.

3.1 Common priorities and gaps for LAC

Even though specific needs for each sub-region have been identified, there are certain aspects common to all:

a. Considering LAC's minimal contribution to global GHG emissions and the risks associated to the impact of climate change on the poor, adaptation to climate change was given a priority focus. Mitigation was only considered important in different sub-regions when linked to vulnerability reduction. All adaptation efforts should be built on the existing knowledge that vulnerable communities have already accumulated, from their long-term experience of adapting to climate variability. Tiessen (2008) warns that this statement should be treated with caution since traditional knowledge may not be useful under radically different conditions. Inter-regional networking will add value to traditional knowledge, since different regions already experience different levels of environmental stress. In addition, the transfer of traditional knowledge, particularly if moderated by science, is proving its usefulness. An example of this is the work on Opuntia cactus, combining experience from Mexico where it is used as a vegetable, with that of Brazil where it is used as dry-season animal feed.

b. There is a need to estimate the potential economic impact of climate change and the costs associated to adaptation options (including the choice of inaction). This information should be of strategic use to draw the attention of governments and the private sector, which still tend to view climate change as an environmental problem. Avelino Suárez (2008) recommends that, when calculating the economic potential impacts of climate change and costs associated with adaptation, the value of goods and services provided by ecosystems to mankind are adequately included.

c. Climate change scenarios need to be downscaled as much as possible if they are to be useful to local communities. The need for downscaling of climate scenarios and action frameworks echoes the fact that risk is always best represented locally and best managed or inspired in terms of solutions at that level (Lavell, 2008). There are some limitations on spatial resolution and computer power to do downscaling as high resolution as possible. An acceptable space resolution is about 40-50 km. Going further than that (10 km) may be complicated in terms of computer power and it is not always the case that high resolution provides better results. Maybe a combination of dynamic and statistical downscaling would be useful for small countries or islands. In some zones such as the Andes, the gap is still so large that climate change scenarios based on down-scaled models should probably be replaced by "what if" planning scenarios (Tiessen, 2008). When producing downscaling scenarios, three conditions are important: (I) link a "bottom-up" with a "top-down" approach; (II) engage outsiders in local processes; (III) consider the scale of the problem and that of the institutional arrangement needed to deal with the problem; (IV) incorporate native traditional Knowledge (Natenzon, 2008).

d. Priority was given to the need to design and implement early warning systems for vulnerable communities and population[12]. This will principally improve medium-term forecasting which is critically important for such issues as disaster preparedness or crop season planning (Tiessen, 2008). "The problem of not placing adaptation to climate change in the right governmental institution is echoed in the fact that the risk management theme is still managed predominantly by civil defense or emergency commission type structures instead of development based or centered institutions." Also, the role of experience in framing the future is reflected in the need to systematize good and bad practice in risk management (Lavell, 2008).

e. Integrated maps of economic, social and environment vulnerability have been repeatedly mentioned as a shortterm priority. The need for more and better quality data on weather, soil and water, demographics, and economic impacts has been continuously highlighted. Most experts insisted on the need to better define what vulnerability means, how a community is vulnerable and to what. In general terms, it can be said that a sector or population is especially vulnerable to climate change in LAC when, exposed to extreme climate events, some or most of the following factors combine to reduce its adaptation capacity:

12 *The World Bank is considering investments along the Cordillera in this respect (Tiessen, 2008).*

Table 3. *Vulnerability Factors*

Category	Factors
Environmental	• Populations or sectors depend on one or a few fragile and/or deteriorated ecosystems. • Water scarcity, access to water, low water quality, and low air quality (urban areas) are key factors.
Social	• Insufficient access to information and knowledge to make individual and/or public adaptation decisions. • High population density in limited spaces. • Weak social capital. • Competition and conflict over access to and control of scarce natural resources (water and land) in contexts of power asymmetries.
Governance	Weak or inexistent institutional responses, characterized by: lack of inclusive and appropriate public policies, insufficient inter-institutional coordination, limited public participation, decreasing representativeness of the political elites, and short-term vision.
Economic	The economic activity under threat is central to the economy of the population under analysis, without sufficient diversification. • Economic sectors of high impact in country competitiveness: e.g. Tourism in the Caribbean. • Low income populations without access to credit or insurance, with difficulties to diversify or change activities. • Insufficient adaptive capacity due to unequal economic, educational and cultural structure. • The economic activity (sector/population) is threatened by conditions and trends of international policies and markets.

Since collaboration between countries should be the rule, common criteria should be used to allow comparison across countries and regions. Apparently, the UN Economic Commission for Latin America and the Caribbean (ECLAC) has made significant advances on economic, social and environmental vulnerability with common and validated criteria that can be used across regions. Yet, according to Natenzon, vulnerability maps requested in the report will not necessarily include all of the elements that condition the capacity to adapt. There are important dimensions that cannot be mapped such as those related to the dynamic of institutions, specific social relations, and political cultures in each nation.

f. Sector specific research on agriculture, health, fisheries, tourism and urban areas has been highlighted as a priority:

- **Agriculture:** Small scale farmers need information on more resistant crops, diversification, improved irrigation systems, and access to policy incentives. Replication of best practices has been mentioned in all sub-regions. Market effects may reduce incentives for diversification even though it would be wise not to rely on only one type of crop and try to diversify. In terms of project design, this means that a tight integration between socio-economic and natural sciences will be needed to be able to explore the real world interactions between environmental stress, markets and motivations (Tiessen, 2008).

- **Health:** Research is needed to better understand the correlation between climate change and the spread of vector-borne and other diseases. Some sub-regions report the presence of diseases that had long ago been annihilated and of other diseases that had never been reported before. Precise information on this topic is needed to help develop preventive policies. According to Marengo (2008), it must be made clear that sanitation and government policies for vaccinations or health care are more important than climate drivers. If the governments do not take care of the sanitation problem, a heat wave or a period with intense rain, or an extended drought period can make things worse and aggravate health problems, without generating them, in present climates. Intricate linkages point to the need for great interdisciplinary awareness: environmental protection - agricultural practice - ecology of rodents - poverty - human health and, finally, the expansion of energy crops are linked in a direct causal chain (Marengo, 2008). Natenzon (2008) complements by saying that social asymmetries in health investment are a more important factor than climate itself. Moreno (2008) suggests it is a priority to model and develop health scenarios with global and regional resolution, considering future distribution of the population by age, future prevalence of lung and heart diseases, and future changes in external drivers of vulnerability. In developing health scenarios three conceptual areas require research: a) recent past evidence (inter-annual or monthly differences in temperatures) and seasons and geographic distribution of infectious diseases; b) evidence of long term trends of climate change and upsurge of infectious diseases; and c) evidence that will allow for the development of biological models that can help estimate the future load of infectious diseases under projected climate conditions. For this to happen, monitoring sites on climate change and human health should be created and integrated into reliable information systems, including a regional network.

- **Fisheries:** Coastal communities that depend on fisheries for subsistence are requesting information on sustainable fisheries management, and on changes in marine currents, in order to select and design new fishing techniques to improve catch rates. Others need information on alternative ways of producing seafood due to higher costs of fuel and lower rate of success. And, finally, others are willing to drop fishing and search for other sources of income, this is also evident on coastal aquaculture activities and fish-breeding areas.

- **Tourism:** How tourism can be affected by climate change is a priority for most sub-regions. While it is central to the economy of Caribbean states, it is also important for other economies and for vulnerable communities who have turned to tourism in the past years. The most important threat outlined during consultations is the risk of damages to tourism infrastructure, either in coastal facilities or in roads to access high-mountain areas.

- **Urban areas[13]:** Seventy five percent of the Latin-American and the Caribbean population live in cities, which have become key determinants and targets of climate change. They are fundamental sources of actions and responses to reduce emissions (mitigation) and to cope with climate change (adaptation). 'Urban' and 'rural' issues relevant to climate change should be discussed as interrelated. A considerable part of the urban population in the region derives its livelihoods from producing or selling goods and providing services to rural producers or inhabitants. There are also the evident rural-urban links for the many locally produced foodstuffs that urban dwellers purchase and for all industries that rely on crops or forest products as inputs. The health of the ecosystems within urban hinterlands is a vital determinant of cities' vulnerability to climate change. As serious events, such as the December 1999 flash floods and landslides in Caracas which killed nearly 30,000, or the floods resulting from hurricane Stan in 2005 (more than 1,500 deaths), have shown us, deforested areas around urban and rural localities are disaster zones in waiting. We do know little on urban adaptation to climate change. As noted by Hunt and Watkiss (2007) and by Huq and Satterthwaite (2008), vulnerability and adaptation of urban areas to climate change has received relatively less attention and research than agriculture or coastal areas. Most of the work on cities and climate change has focused on coastal cities and on urban centers of developed countries (Hunt and Watkiss, 2007). Latin America has a long history of adapting to the impacts of stresses related to climate variability – e.g. El Niño Southern Oscillation (ENSO), hurricanes and floods. The measures include autonomous adaptation practices for which there are very few documented case studies. The most frequent practices include reactive or ex-post adaptations, for z--example, emergency response and disaster recovery (ECLAC, 1999 and 2007).

g. Four key cross-cutting issues for all sub-regions are food security; water management; ecosystem resilience, and governance:

- **Food security:** Due to potential climate change impacts on agriculture and water availability, food security was raised as a key concern in all sub-regions. Technological innovation is considered key to potential adaptation possibilities.

- **Water management:** All sub-regions state the importance of integrated water management as a means of ensuring water security. There is an urgent need for information on policies and techniques for efficient use, improved irrigation, rainfall water management, supply vs. demand analysis, micro watershed management, salt-water intrusion, recharge of aquifers, among others.

- **Ecosystem resilience:** There is a shared concern that ecosystem degradation is increasing vulnerability to climate change impacts. Managing terrestrial and marine ecosystems in a way that can ensure their resilience and capacity to continue providing goods and services, including conservation policies and protected areas, has been recommended as a key adaptation strategy. The clean development mechanism has been mentioned repeatedly as an opportunity for contributing to mitigation and simultaneously reducing vulnerability through forest conservation and watershed management. Until now, however, little evidence exists in LAC of concrete achievements.

- **Governance:** Vulnerability needs to be understood not as a random result but rather as the product of a set of public policies. Participants have expressed the need to learn about new institutional arrangements for decision-making on climate change, in coherence with the complexities of this phenomenon. Inter-institutional coordination has been signaled as key, yet still lacking, condition for success. Further participation of social scientists in research initiatives is encouraged to better understand how the link between science and policy is actually working and how it can be improved.

Finally, a new methodological approach to research needs to be adopted. Beneficiaries and decision-makers need to be included right from the outset of the process if results are expected to be useful to any of them. Methodological approaches that engage local stakeholders from the beginning are not necessarily that new. What would be innovative would be that funding institutions request them, scientists take them up as valid and useful, and decision-makers have the political will to engage (Natenzon, 2008). Also, considering the complexity of the climate change phenomenon, an interdisciplinary approach is considered a must in all research initiatives and special efforts need to be made to strengthen the

13 This section follows the arguments presented by Patricia Lankao Ramírez in her review of the report.

capacity of professionals from some fields that do not yet have a consolidated presence in the climate change debates, such as economists. A very useful tool to map information needs for policy-makers, produced by Mesoamerican participants, is featured on page 42.

3.2 Research priorities per sub-region

3.2.1 Caribbean sub-region

a. Overview of climate variability and change in the Region[14]

Most of the islands in the Caribbean lie within the hurricane belt and are prone to frequent damage from seasonally intense weather systems. The reality of the vulnerability of the region was highlighted when Hurricane Ivan hit Grenada in September 2004. Damage assessments indicate that, in real terms, the country's socio-economic development has been set back by at least a decade – by a single event which lasted only a few hours! So, even, without climate change, the integrity of the region's natural resources is already compromised by existing environmental stresses.

Although the full impacts of climate change are unclear, it is certain that it will exacerbate present-day regional vulnerability to climate variability. Despite wide acceptance of this, the response from Caribbean states to climate variability and change has been inadequate. This is mainly due to lack of resources to provide assistance where many natural systems are much degraded, and human systems are highly inflexible.

Studies in the region, so far, confirm that climate in the Caribbean region has changed in a manner very consistent with the observed variations at global and northern hemisphere levels. Temperature records have shown an increase in the last century, with the 1990's being the warmest decade since the beginning of the 20th century 1998 being the warmest on record. Results from studies done by the Institute of Meteorology (INSMET) in Cuba and the University of the West Indies (UWI) indicate that the region is warming; the diurnal temperature range is decreasing; the number of warm days in the region is increasing but the number of very cold nights is decreasing; the frequency of droughts is increasing and the frequency of extreme events in the region seems to be changing. With respect to the latter, flooding events and hurricane passage through the region have increased since the mid 90's.

Using the Hadley Center's PRECIS regional climate model (PRECIS Caribbean Climate Change Project, 2007) preliminary outputs indicate an annual warming by the 2080s of between 1º and 5 º C depending on the region and scenario employed; greater warming in the northwest Caribbean territories (Jamaica, Cuba, Hispanola, Belize) than in the eastern Caribbean island chain; and greater warming in the summer months than in the cooler and traditionally drier earlier months of the year.

The main projections of change in average rainfall are: a drier main Caribbean basin in the annual total by 2080s, except for western Cuba, South Bahamas, Costa Rica and Panama; a pronounced north-south gradient in rainfall change during the Caribbean dry season (January to April); and a more severe summer drying during the Caribbean wet season.

In essence there seems to be enough evidence to conclude that: climate in the Caribbean is changing in line with global trends; average temperature has increased and will continue to do so; precipitation patterns are changing, leading to a drier Caribbean; hurricane intensities are increasing and there is a tendency for hurricanes to form further South than normal; there is a shorter return period for extreme events (floods, droughts); sea water temperatures have increased (leading to episodes of bleaching of corals); and sea level is rising (leading to aquifer intrusion and salination). (Charvériat, 2000; Mimura et al., 2007; Taylor et al., 2007; and, Trotz, 2001)

b. Research priorities resulting from multi-sector consultation.

Caribbean participants considered the following as their research priorities:

There is a short-term need to understand current and future **water** availability considering consumption patterns, and the potential impacts of unpredictable changes in rainfall patterns affecting economic sectors such as agriculture. It is a priority to understand the key factors that lead to failure in watershed management at all levels. Similarly, the region would profit from information about how to manage the predicted increase in floods as a result of climate change.

14 *Prepared by Ulric Trotz for this consultation process, January 14th, 2008*

It is important to determine, in the short-term, the impacts of climate change on **agricultural farming systems** (including fisheries), food trade and food affordability to aid in the development of a **food security** policy for the Caribbean. Global Environmental Change and Food Systems (GECAFS) did a study in the region including the likely impacts of climate change on food security. However, no scenario modeling was conducted to look at the correlation between food security and the effects of climate change. Therefore, one of the priorities would be to conduct research to model how effects of climate change will influence food security under various scenarios.

There is an urgent need to understand the effects of climate change on the agricultural sector from food production to marketing. This includes crops, livestock, forestry and fisheries sectors. Agricultural activities rely mainly on 'rain-fed' type irrigation. One of the likely scenarios emanating from climate change is the change in rainfall patterns, frequency and intensity. Therefore, research should be conducted to identify which farming systems will be more appropriate and also the alternative crops which could be cultivated in response to these changes. As well, there is specific interest in harnessing traditional knowledge in agricultural practices, currently being ignored and/or not documented despite good levels of success, to inform adaptive strategies. There are a large proportion of small scale farmers who operate in a condition of minimal protection, few incentives, little or no subsidies, and no insurance schemes. There is a need, therefore, to conduct a study to determine the likely financial vulnerability of small scale farmers in the region with regard to the effects of climate change. Such a study should also determine and devise appropriate insurance and other risk management mechanisms to protect small farm holdings, thereby sustaining the agricultural sector and the livelihood of a significant proportion of the region's population. According to Marengo (2008), there has been little progress on insurance and climate change, especially in the rural area. This is also true for climate variability in present times, and there is a need for risk assessments for climate change.

Understanding how increases in temperature due to climate change will affect the **health** of the Caribbean populace and also what measures could be taken to reduce mortality from this phenomenon comes up as a short-term priority as well. Specifically, preliminary studies in the Caribbean gave early indications that climate warming is affecting vector borne diseases. Warm temperatures are likely to accelerate the breeding rate of mosquitoes, but this is just from an analysis of past data. More studies are needed to determine whether there is a correlation between a warming climate and these diseases. Similarly, information related to the implication of pollen and dust on human health is available in the Caribbean but there is a deficit of relevant attribution information. Therefore, more attribution studies need to be conducted to determine whether there is correlation between diseases such as respiratory infections and pollen/dust etc.

According to the Convention on Biological Diversity (CBD), the Caribbean is one of the major **biodiversity** hotspots in the world, holding many endemic species. There is a long-term need to understand how inter-seasonal and inter-annual climate variations will likely affect both marine and terrestrial biodiversity of the region. As these effects intensify, the services provided by the various ecosystems will be compromised, therefore studies, similar to the one conducted for coral reefs by World Resource Institute (WRI), (2003) need to be undertaken to provide a monetary valuation of the other ecosystems in the Caribbean[15]. Also, although there are many Protected Areas (PA) in the Caribbean, their success rate (both terrestrial and marine) is questionable. One cited reason is the inadequate knowledge on the habitats and also the factors to consider in designing a PA. Research is needed in the short-term on how to design and manage PAs for the amelioration of biodiversity. It would also be convenient to know in the medium term what the changes in the hydrological cycle will be and how these changes will affect the forest ecology of the region.

For all the priorities listed above in the various sectors, the economic implications (economic loss, economic importance), governance and effective information dissemination must also be investigated through research.

Given the huge dependence on hydrocarbon and also the projected economic strain that increasing market prices will have on the small islands, there is a short-term need to understand why the region is highly **energy** inefficient, both in usage and generation and also what policies are needed in order to address these inefficiencies. Although alternative energy is being pursued in the region, it is agreed that the rate of change is slow. The reasons hampering the rate of adaptation should also be identified via research in the medium term. The abundant forest resources in some countries in the Caribbean (Guyana, Dominican Republic etc) provide the potential to use the resources to sequester carbon. In this way they could contribute to the global drive to reduce the effects of carbon emission and could obtain financial resources to conserve biodiversity. Therefore, research should be conducted in the long term to provide the scientific information about the true potential for carbon sequestration in the sub-region.

The potential for the Clean Development Mechanism (CDM) and adaptation/mitigation measures to respond to climate change is considered high in the region, and there are many planned and ongoing **private sector initiatives** which are done ad hoc. There is a need to collectively assess the on-going and planned initiatives/options and the needed policy measures (including subsidies) to encourage the private sector to explore these options. In addition, there is a need to conduct research into "Caribbean-appropriate" corporate social responsibility, including the reporting guidelines. With regard to corporate social responsibilities, an assessment was conducted for Trinidad (please see www.stcic.org).

15 *José Marengo recommends, as well, the relevant chapter of IPCC AR4 WG2*

The **tourism** sector is not fully aware of the potential economic impacts of climate change on their activities. Instead, representatives from the tourism sector are more concerned about the opportunities that mitigation could provide to their industry. Along these lines, some of them believe the Caribbean could be promoted as a Zero-Emission tourism destination and believe there is a need to determine and explore effective ways in which insurance services can provide incentives or disincentives to reduce GHG in the tourism sector.

Concentrated coastal development and ill-designed infrastructure make the Caribbean region particularly vulnerable to **natural disasters.** There is a need to identify ways in which climate change information could be mainstreamed to reach all sectors of society, in an effort to influence development and minimize the impacts (economic loss, fatalities, etc.) arising from climate change related natural disasters.[16]

All research priorities listed above should include social vulnerability as a key factor of analysis and specific efforts should be made to identify best practices that enhance the resilience of vulnerable communities. There are four main factors that can help map vulnerability:

- Lack of governance and enforcement;
- Concentrated population on limited resources and land areas;
- Coastal vulnerability;
- Monoculture dependent economies e.g. – agriculture, tourism and fisheries.

Three cases were analyzed during the final workshop to illustrate how these factors interact: Cartagena (Colombia), Phillipeau (Haiti), and Grenada and Bermuda. Further information can be found in the report of the final workshop.

3.2.2 Andean sub-region

a. Overview of climate variability and change and its impact in the Region[17]

The Andean Region is experimenting changes in weather patterns consistent with global trends. Temperature has risen between 1°C and 2.2°C in the last 50 to 70 years and a general decreasing trend in rainfall is registered in most countries with an increase in extreme events during rainy seasons. Regarding climate projections, the Region is not an exception either. In its last report, the IPCC predicts an increase in temperatures in the Andean Region of at least 3°C (IPCC, 2007b) during the current century. While rainfall patterns will vary significantly from high latitudes (increase) to subtropical areas (decrease), projections made in Peru and Colombia indicate a decreasing trend.

Poverty (50%) and extreme poverty (between 15% and 30%) seriously limit the response capacity of the population to climate change (Andean Community Secretariat, UNEP, Spanish Cooperation Agency, 2007a). And, while Andean countries hold a wide diversity of ecosystems and species, advanced degradation has limited their resilience. So, even though Andean countries only contribute 2% of GHG global emission, they are highly vulnerable, socially, environmentally, and economically to some of the effects of global warming listed below:

- **Increase in natural disasters related to extreme events:** 68% of natural disasters respond to hydro meteorological phenomena. There is an increase in emergencies caused by climate events, mainly floods, landslides, wind gusts, and droughts, that demand unexpected allocation of scarce financial resources.

- **More frequent droughts and decrease in water availability:** High deforestation rates -47'000 hectares/year in Colombia to 198'000 hectares/year in Ecuador (FAO, 2005)- have accelerated land degradation processes, affecting hydric regulation, local climate and desertification trends in areas that already have water availability problems. This, as well, is seriously impacting on productive agricultural systems, exacerbating social and economic problems in the region. Arid, coastal areas are presenting desertification and drought processes that are expected to increase during this century, affecting water supply to local communities and small cities and risking the provision of hydroelectric energy.

- **Glaciers in retreat:** Glaciers, especially in tropical zones, are excellent indicators of the climate evolution and provide important reserves of drinking water. Glaciers have shown unprecedented withdrawals in the last 20 years and most of them are destined to disappear in no more than 30 years. In the short term, this means an overload of water reservoirs, floods, and landslides. In the longer term, this may cause severe reduction in water availability for human consumption, agriculture, industry, and energy security.

- **("Páramo") deterioration:** High altitude Andean grasslands, known as "paramos", are natural regulators of hydric supply. Paramos are being deteriorated by cattle-raising where peasants who do not have alternative sources of income. As a result, water availability for populations located below is being threatened.

- **Food security:** The Ministry of Environment of Ecuador in 2001 stated that an increase of 2°C in temperatures and a decrease of 15% in rainfall (probable IPCC scenarios) would reduce in 49% the supply of rice which would have to be covered with imports and an increase in 51% of the cultivated surface. Similarly, the supply of potato would be reduced in 34%, requiring additional imports and an increase in 38% of arable land. Rice and potatoes are two of the crops with highest per capita consumption rates. This would certainly increase deforestation processes and socio-economic vulnerability. While this is disaster scenario that is unlikely to happen -since optimal zones would shift, and rice and potatoes grow in very different eco-regions (Tiessen, 2008) -, a shadow of uncertainty still remains as to how these changes in temperature and rainfall patterns could impact food security.

- **Rising sea-level:** The lower basin of the Guayas River in Ecuador provides a daunting example of potential consequences of a rising sea-level. It is one of the most important industrial, commercial and agricultural areas. A 0.3 m rise in sea-level during this century could cause severe impact to natural and economic systems in the area. Salt water intrusion in the Daule River could affect the provision of drinking water in Guayaquil and adjacent cities, as well as their sanitation services. Around 200.000 people would have to be evacuated, 342 Km^2 of mangrove would be lost, and approximately US$ 1.300 million would be lost in the shrimp industry, trade and agriculture (banana, sugar cane and rice).

b. Research priorities resulting from multi-sector consultation.

The region needs more information on social, economic and environmental impacts of climate change with good quality and continual data series.

Specifically, new information on **climate change scenarios** needs to be developed at a regional or local scale to determine specific impact (such as altitude malaria or agricultural production), trends, and magnitude of change (gradual or abrupt). Meteorological and hydrologic observation networks need to be enhanced. Climate change indicators and monitoring protocols for carbon and water cycles need to be developed to allow processing of standardized information. Effective early-warning systems are required. However, it should be noted that downscaling will only be useful if local users of information are involved in the research process since the very definition of the problem. The Instituto Geofísico del Perú (IGP) in the Andean Region holds important lessons learned while working with agricultural producers to provide them with the science they need to effectively adapt to climate change.

The region needs to produce **vulnerability maps** to establish investment priorities. Specific vulnerability studies or indexes are requested regarding energy, health (eco-epidemiological studies), water availability, food security, coastal and insular areas, agriculture, cattle-raising and biodiversity, and should link the analysis to the dynamics of international trade. In this task, standard criteria and methodologies need to be developed to define vulnerability. Participants deemed it was also necessary to produce information regarding changes in human behavior resulting from climate change, such as migration or confrontation over scarce resources such as water.

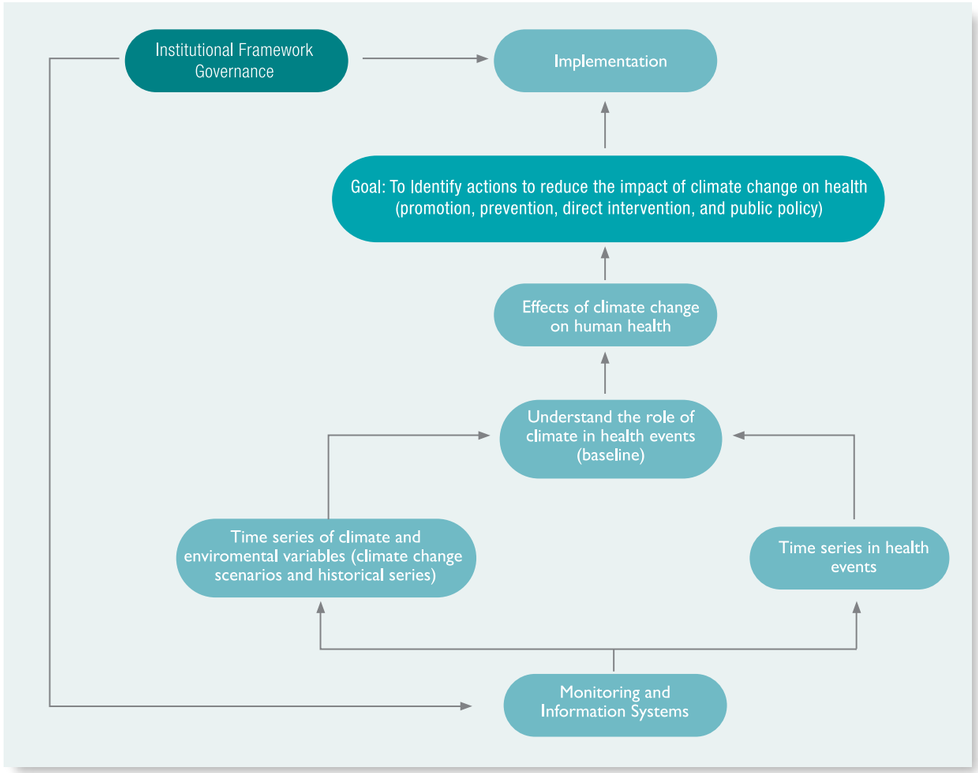
There are ongoing initiatives in the sub-region to develop methodologies to determine vulnerability considering numerous factors and approaches (river basin, ecosystem, economic sector, population) but they are still preliminary approaches[18]. They need to be complemented with the following activities: i) gathering of existing information; ii) strengthening of inter-institutional coordination capacities; iii) standardizing concepts and methodologies; iv) outlining urgent gaps; v) validating of results with governments, research institutions, communities, and private companies; vi) designing information systems that can function as a continuous basis for decision-making.

There are three key research cross-cutting issues that have been prioritized by the group: health, food security, and high-mountain ecosystems providing water for large cities. A detailed analysis of threats, level of exposure, sensitivity, and adaptation capacity for health and food security is provided in the report of the final workshop.

Regarding **health**, participants summarized research needs in the following chart:

16 *Marengo states that natural disasters are most related to meteorological phenomena, and there is a need for quantification of their frequency and intensity in present climates, before considering them in a climate change context (Marengo, 2008).*
17 *Prepared by Adriana Soto for this consultation process, February, 2008.*
18 *Andean Regional Project (Bolivia, Ecuador, Perú) on vulnerable river-basins; Colombian Adaptation Project on health, high-mountain ecosystems, and insular zones; Project on adaptation to climate change (SDC) in two vulnerable regions (Cusco and Apurimac); SCNCC Projects.*

Figure 3. *Health research needs*



Statistical epidemiologic models need to be developed to keep track of the evolution of diseases and pests. For example, old diseases that had disappeared and were studied in history of health are reported to be surging back again. According to experts participating in the sub-regional and final consultations, malaria has been found close to La Paz in Bolivia and climate change seems to be facilitating the emergence and spread of pests.

As to **food security,** participants have identified the following key research topics:

- Identifying and assessing traditional practices and strategies to adapt to climate variability. E.g.: Water harvesting (green water); biodiversity harvesting; plague and disease control; soil fertility; and social practices.
- Designing and valuing a "basket of crops" (diversity) with capacity to respond to climate variability extreme events, and low-demand of water.
- Conserving "harvested biodiversity": restoration, protection and management mechanisms.
- Identifying and validating good practices for micro-basin and aquifer management, and irrigation improvement with an Integrated Water Resources Management (IWRM) view.
- Studying trends in conflicts related to water and their link to mining, agriculture, the environment, and demand from large cities.

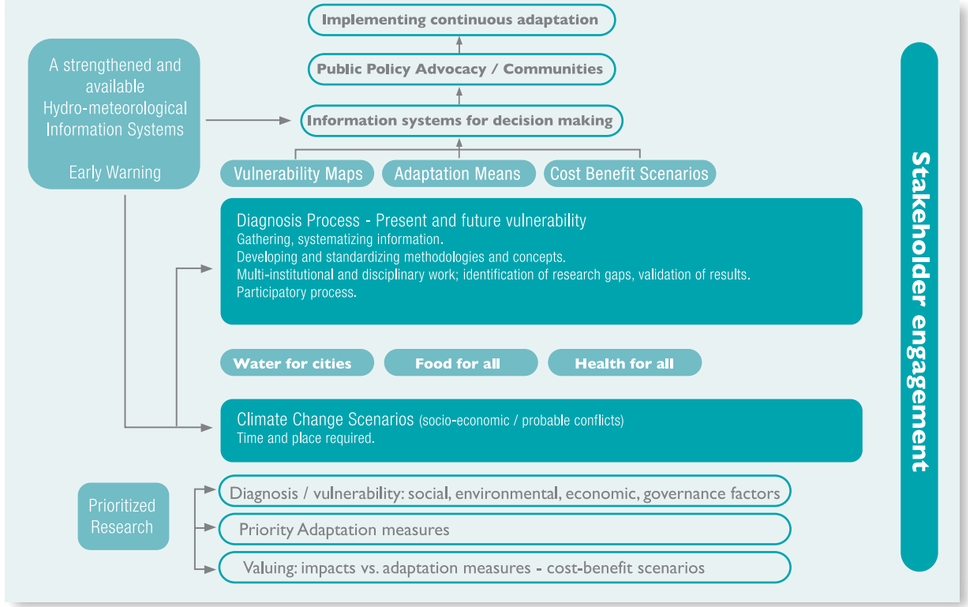
Regarding **water for cities**, research would be oriented towards ensuring water provision for strategic cities (Bogotá, Quito, Lima, La Paz and other municipalities) considering threats posed by climate change. Research needs would include: i) climate scenarios in high-mountain ecosystems, especially studying "paramos" degradation and glacier retreat, and ii) water balance, analyzing both demand (present and projected) and supply. Adaptation mechanisms should include: promotion of conservation of "paramos" to ensure its resilience and provision of services; conservation of river-basins that depend on glaciers; efficient water use in agriculture, industry, and human consumption; and effective implementation of integrated water-management policies.

It is important to reiterate that, in addressing these and other issues, local communities have often and spontaneously coped with climate variability in the past. It is crucial to rebuild the history of climate variability, explore the different **adaptation** choices made by communities, using their traditional and indigenous knowledge, and identify successful practices that could be disseminated. Information on new technologies and associated investment costs is also welcome. Integrated assessments are essential to understand positive and negative effects of adaptation choices, e.g. building a reservoir could prevent flooding or secure water availability but could incubate diseases.

Significant efforts need to be made to calculate the projected **costs** of climate change and adaptation, in order to decide over investment. Scientists should develop the necessary tools to provide reasonable data on economic costs to decision-makers. Related to this point, participants felt that it is not fair for the region to cover the costs of a problem to which Andean countries contribute with only 2% of GHG. A suggestion was made to focus research on international mechanisms, through negotiations or courts, to demand fair compensation from Annex I countries.

Participants decided to illustrate these conclusions in the following chart, which can be adapted and used as well for other sub-regions:

Figure 4. *Andean Research Needs*



Interest has also been expressed in **mitigation linked to adaptation**, specifically regarding control of deforestation as an effective means to reduce emissions and limit vulnerability related to regulation of water ecosystems. Forest conservation, sustainable alternatives to forest-clearing agriculture and use of renewable energy are seen as the best ways forward. Additional attention could be given to mitigation initiatives related to efficient mass transportation systems and to reduction of methane emissions from cattle-raising. CDM projects associated to adaptation are also perceived as favorable to local development strategies yet participation of Andean countries in CDM projects is very scarce and mostly related to hydro-electric initiatives, but with little reinvestment of Certified Emission Reduction (CER) credits in watershed protection (as in the case of Bogotá). An important opportunity would open for Andean countries if forest conservation projects were allowed into the UNCCC framework. Therefore, a more strategic and unified stance is needed from the Andean countries in current international negotiations.

There is also a need for knowledge on new **institutional arrangements** needed to define and implement cross-sectorial climate change public policies that address climate change and its effects. Public policy should build on existing adaptation practices.

Finally, other topics to be studied include: opportunities generated by climate change in mountain ecosystems; impact of climate change on bio-fuel production; impact of climate change on coastal and marine biodiversity.

3.2.3 Mesoamerican sub-region

a. Overview of climate variability and change and its impact in the Region[19]

Similar to other sub regions, an increase of 1-2 ºC in temperature is projected during the next 50 years and a decreasing trend in rainfall patterns is projected.

Presently, Mesoamerican countries rank very low in diverse international vulnerability indicators. For example, the results of the Vulnerability-Resilience Indicator Model (VRIM), developed by Yohe et al. (2006), show Mesoamerican countries ranking in positions ranging from 38th (Costa Rica) and 82nd (Guatemala) among the 100 most vulnerable countries in the world. This vulnerability can be evidenced in the following factors.

- **Ecosystems:** Ecosystems act as buffers against the impacts of climate change. Yet, degradation rates in forests, watersheds, aquifers, mangroves and other ecosystems in the sub-region are increasing alarmingly, leading to social vulnerability. Efforts to handle emergencies, improve reconstruction capacities, or establish early-warning systems, among others, will not make an important difference if adequate conservation of natural barriers is not a priority.

- **Agriculture:** By 2050, it is expected that 50% of cultivated land will be affected by salination and desertification (Magrin and Gay, 2007), impacting the production of corn, rice and other crops. Models, evidence, and producer perception indicate that coffee production will suffer negative impacts, especially in the selected coffee plantations in Las Segovias, Nicaragua, where rainfall is expected to drop 30% in the coming 50 years.

- **Water:** Hydric stress is expect to occur in eastern Central America; Motagua and El Pacífico valleys in Guatemala; eastern and western El Salvador; Central and Pacific Costa Rica; inter-montane regions in Honduras; and the Azuero Peninsula in Panama. (Magrin and Gay, 2007). Accelerated urban growth, increase in poverty rates, and low investment in water and sanitation services are likely to worsen the quality of life of millions of people. In rural areas, inadequate agricultural practices (deforestation, soil erosion, and overuse of agrochemicals) are deteriorating water quality and quantity.

- **Coastal zones:** Rises in sea levels and temperatures are likely to produce serious impacts between 2050 and 2080, including flooding, salination, population desplacements, erosion, mangrove degradation. In those countries where tourism makes a significant contribution to the GDP and employment, significant economic imbalances can be expected.

- **Health:** High relative risks of death caused by malaria, diarrea, and dengue are projected by 2030 in Central America. (Magrin and Gay, 2007), seriously impacting costs of health services. Some models suggest changes in spacial distribution (dispersion) of vectors.

- **Natural disasters:** Mesoamerica is highly vulnerable to extreme events. In 1998, Hurricane Mitch caused US$ 4 billion in losses. While Mitch was a milestone in climate history in the Region, it must be stated that between 1980 and 2004, Mesoamerica lost an annual average of 0.83% of its GDP, due to natural disasters.

19 Prepared by Alfaro and Rivera for the consultation process, February 2008.

b. Research priorities resulting from multi-sector consultation

Participants in the sub-regional consultation highlighted the need to **downscale climate change scenarios** to be able to determine concrete impacts of climate change. Comparable information and time series are required to project trends at the local level. There is a specific need to strengthen capacities in the region to systematically monitor hydro meteorological variables, especially rainfall, tides, and flows, and to research historical data. Participants also noted the need to use two key tools: geo-referentiation of climate change information, and early warning systems.

Multi-threat **vulnerability** maps, especially focused on water availability, are not available in the Region. A call was made to develop models for integrated management of vulnerable areas, in order to include health, food security, water resources, energy, and economics in decision-making. Regarding factors that configure vulnerability, table 4 shows the analysis made in the final workshop, after analyzing the case of the Valley of Sula (Honduras), the Mesoamerican Dry Corridor (México to Panama) and the health situation in Mexico City (Table 4).

Additional information can be found in the report of the final workshop.

Participants considered it useful to develop packages of **adaptation strategies** for communities and specific sectors, incorporating adequate analysis of economic costs of different options.

It was noted that it is not always possible to choose the soundest option. For example, regarding agriculture it would be wise not to rely on only one type of crop and to try to diversify, but international markets are nowadays requesting large-scale production of single crops. Mexico's decision to expand the cultivated area as an adaptation choice is likely to have a severe impact on forests and small-scale farmers.

Particular attention was paid to options that serve both for **mitigation and adaptation**, as a means of alleviating poverty and increasing productivity. Dissemination of good mitigation practices linked to adaptation, detailing obstacles faced in implementation, should be considered a priority in the region.

Regarding sector-specific research topics, participants gave priority to energy, coastal zone livelihoods, health, and food security. Water was considered a key cross-cutting issue. Then participants focused on what kind of information a decision-maker would need and listed the following: baseline; vulnerability factors/indicators; key stakeholders to engage; history of impact and adaptation; climate change impact scenarios; adaptation scenarios; cost – benefit analysis; monitoring and evaluation of adaptation decisions. Finally, they created a matrix that combines policy information and sector-specific research topics. The boxes indicated high, low or medium current availability of information, based mainly on the perception of participants in the final workshop of the consultation, rather than on objective and verifiable data (Table 5).

Table 4. *Vulnerability factors (Mesoamerica)*

SECTOR	RURAL AREAS	URBAN AREAS
Environmental	Fragile and/or deteriorated ecosystems.	Water and air quality; loss of vegetation and green areas.
Social	Unplanned population growth without adequate sanitation systems; low education rates; limited social investment; migration.	Unplanned urban growth without access to basic services: drinking water; sanitation; energy use; infrastructure.
Governance	Lack of institutional linkages; short-term views; weak river basin management; lack of ecosystem visioning; centralized decision-making; divorce between responsibilities and available resources.	Vertical governance structures without participation of civil society; inadequate linkages between policies and risk management.
Economic	High impact on country competitiveness or development; lack of access to capital.	Subsidies for water, transportation and electricity; huge gap in quality and costs of access to public services vs. private services; extreme poverty.

Table 5. *Current availability of information for decision-makers on various sectors and thematic areas (Mesoamerica)*

Sectors / Thematic Areas	Coastal Zones	Health	Food Security	Energy
Baseline	Medium	High	High	High
Vulnerability factors/indicators	Low	Medium	High	Medium (transmission)
Key stakeholders to engage	Medium	Medium	Low	Low / Zero
History of impact and adaptation	Low / Zero	Low	Medium	Medium
Climate change impact scenarios	Low / Medium	Low	Env: Medium Social: zero Econ: medium Gov: zero	Low (env-0, soc-0, econ-medium, gov-0, ef.f.-medium)
Adaptation scenarios	Low / Zero	Low / Zero	Low	Low
Cost – benefit analysis	Low	Low	Low / Zero	Medium
Monitoring and evaluation of adaptation decisions	Low / Zero	Low	Low	Low

All participants considered this table as significantly valuable and would have wanted to apply it to other sub-regions as well. Unfortunately, the ratings (high/med/low) only reflected perceptions of the Mesoamerican participants in the final workshop and it was virtually impossible to obtain the perceptions of the participants of the rest of the sub-regions. The team did not consider it appropriate to bridge this gap with its own interpretation.

The Presidential Summit of Central America and the Caribbean (Honduras, May 2008) on Climate Change and the Environment reached an agreement on the following topics for a research agenda, which fall in line with what came out of the consultations:

- Climate change needs to be incorporated as a cross-cutting and high-priority issue in national development plans, including the analysis of future scenarios.
- Systems and indicators to assess vulnerability need to be developed for key sectors: health, water, agricultural production, forestry, fishing, tourism, energy and infrastructure.
- Promote adaptation and vulnerability reduction in rural and urban system. Insurance companies have a key role to play in the process.
- Close cooperation needs to be maintained with research centers, promoting inter-sectorial approaches, and economic valuation of climate change impacts.

3.2.4 Southern cone sub-region

a. Overview of Climate Variability and Change and its impact in the Region

In general terms, the Southern Cone sub-region is highly vulnerable to the impacts of climate change. Firstly, climate change is expected to have devastating consequences on the abundant natural resources of the region, such as large extensions of forest, important biodiversity reserves, substantial water resources, wetlands, and its varied composition of climates and ecosystems (Vergara, 2004).

- **Water availability:** Existing literature highlights the potential vulnerability of the region associated with the effects of climate change over water resources:
  - A predicted reduction in rainfall may pose a significant threat to hydroelectric projects in Brazil and Chile.
  - Also, the increasing glacier retreat phenomenon is threatening long-term water reserves. Ninety percent of the glaciers in Chile are experimenting severe retreat processes. Something similar is occurring in Andean provinces in Argentina.
  - Additionally, droughts caused by the current of "La Niña" increace vulnerability related to water availability for irrigation in central and western Argentina, and central Chile.
  - A reduction in river flows in the last stretch of the La Plata River Basin is expected.
  - An increase in hydric stress in northern and western areas of Argentina, central and northern Chile, and southern Paraguay is expected.
  - The Chaco area is likely to be affected by an increase in the rate of desertification and land-degradation processes, seriously impacting "campesino" and indigenous communities who depend on small scale agriculture.
- **Agriculture:** Climate change may have very different impacts on crops of national economic relevance, such as corn, soy, wheat, and coffee. According to Tiessen (2008), corn has very specific seasonal susceptibilities to even temporary drought stress. Soybean breeding is moving this crop further into new regions, and between different cultivars, an increasingly broad range of climate zones are becoming suitable. Soybean expansion comes with the introduction of soil conservation measures, which certainly cannot only be seen as problematic. At the same time, today's zero-till soybean production systems depend entirely on a single genotype which brings with it significant vulnerabilities. Wheat has a relatively broad spectrum of suitable climates and will suffer only under extreme climate change in its current range. Actually, its range is more determined by other more competitive crops than by its own climate susceptibility. Coffee is critically vulnerable on the margins of its range. Excess temperature during flowering will eliminate coffee production. This is a potential danger in the state of São Paulo. In southern Brazil, extreme events of cold are more likely to continue to affect coffee and citrus for some time, despite global warming trends. This is related to South Atlantic air circulations.
- **Biodiversity:** Climate change may impact the rate of biodiversity loss in the Chaco Region (Paraguay and Argentina), further affecting indigenous communities and peasants who depend on it for food, medicine, crafts, and religious practices.
- **Natural disasters:** Very recently, the coast of Brazil experienced new extreme climate events, such as tornadoes and hurricanes. Yet, the uncertainties in the projections of hurricanes in this region are very high.
- **Sea-level rise:** Also, a rise in sea-level is expected to affect the coast of the La Plata Basin and other coastal areas in Uruguay. The most significant impacts of climate change would be caused by sea-level rise in the coastal areas, where most cities, tourism sites, strategic infrastructure and industries are located.

b. Research priorities resulting from multi-sector consultation

Participants focused most of their contributions on the need to have more and better information on social, environmental and economic impacts of climate change.

As in other sub-regions, there is a repeated need to **downscale climate change scenarios**, linking sectorial and territorial analysis. There is also a need for governments to design and implement early warning systems, especially for droughts and floods, which consider vulnerable communities as a priority and include their active participation. For this to happen, information on climate, hydrology, soil, and water availability should be gathered and updated. Particular attention needs to be paid to the reconstruction of meteorological history and, where possible, make it available digitally and online. Information would even be more profitable if it could be generated in cooperation among different countries and between the offices of the conventions on climate change, desertification and biodiversity, who do not work together very frequently.

Socioeconomic and geographic **vulnerability** assessments and maps should be produced by different countries but utilizing common criteria so as to make the information comparable. An interdisciplinary approach is considered a must. It is important to state that, though poverty is usually a driver of vulnerability, it should not overshadow exposure to threats. Not necessarily all poor communities are vulnerable if they are not exposed to threats. The following tables present three sectors analyzed during the final workshop with their corresponding vulnerability factors:

Table 6. *Vulnerability Factors (Southern Cone)*

Sectors	Factors
Small scale agricultural communities	- Threats: exacerbated weather patterns resulting in droughts and floods. - Competition over scarce resources (water and land). - Limited adaptation capacity due to inadequate institutional and technological responses (e.g. the promotion of avocado in Chile). - Gradual loss of social capital (migration) and solidarity, as modernity influences their cultural processes. - Expansion of the agricultural border for single-crop production favored by climate change (e.g. soya in Argentina and Uruguay).
Urban communities	- Threat: High exposure to extreme climate events due to inadequate location of houses. - Limited institutional and infrastructure capacity to adapt to climate change; ineffective territorial planning. - Weak social capital. - Lack of information and knowledge for individual decision-making. Too much focus on past climate events and little understanding of projected future impacts of climate change. - Low income.
Energy (Hydroelectricity)	- Water scarcity and variability. - Low efficiency in energy use due to limited focus on energy demand and too much attention to energy supply. - Limited information regarding water availability. - No territorial planning. - Exponential increase in energy costs plus inequality in cost distribution.

A participant mentioned there is a "Babel-Effect" in the way climate change, particularly **adaptation**, is being addressed. While government agencies get tangled in plans and do not coordinate their efforts, communities have never waited to adapt to climate variability and have accumulated knowledge on how to do it. So, rather than trying to put together the perfect plan that will never be implemented, good principles for management and governance should be developed, upon which best practices can be defined in local and changing contexts. Knowledge on adaptation practices should be extracted from the experience of local communities, both rural and urban. Also, 30 years of experience in technological adaptation to climate variability held in agricultural institutes (such as the Instituto Nacional de Tecnología Agropecuaria –INTA- in Argentina) should not be underestimated. While good practices are welcome, it should be noted that they are not always replicable. "Bad practices" should be studied as well to understand factors that lead to failure, provided key stakeholders are willing to share information.

One participant mentioned that concentrating too much effort in future prediction may not be as effective as learning from comparison. He mentioned a study being conducted in the Elqui River Basin in northern Chile and in the Saskatchewan Basin in Canada. Researchers involved in the program say that similar processes will be at work in both basins since both are in dry areas and the major rivers are mountain/glacier fed. This is an example where the exchange of knowledge is very useful, but the underlying ecology and socio-economic contexts are so different that adaptation-relevant research must be adapted to the regional circumstances (Tiessen, 2008). History is used to study how communities in the Elqui Basin have adapted, how their perceptions, values, and power relationships have changed. This can only be achieved through a multidisciplinary team.

Economic impact of climate change and **costs** associated to possible adaptation choices (including the choice of inaction) need to be carefully assessed. This would be the most strategic way to capture the attention of both governments and the private sector. While governments are less likely to use long-term thinking and action, private companies will value any information that can bring light on the risks of their investments. This may result in a willingness to support further research. Standardized methodologies are necessary to obtain comparable results, especially if binational studies for shared ecosystems are to be conducted.

Various participants pinpointed the need to study the relationship between science and policy regarding climate change in order to build the necessary inter-phases between them. Also, it would be interesting to design learning instruments that could inform **new institutional models** for decision making. It should be interesting and useful to understand how asymmetrical power relationships interact to build public policy on climate change.

Health and climate change was, once again, mentioned as a priority research topic. Health indicators associated with climate change (including morbility data) are needed to determine how many more people suffer from diseases because of climate change. Also, more information on the role of climate change in propagation of pests would be welcome.

Finally, a few other topics were mentioned repeatedly, as deserving attention of future research initiatives: update and further production of information on estuaries (there is an interesting initiative being carried out in Uruguay on the estuary of the Río de la Plata) and sea-level; complete existing information on the impacts of climate change on biodiversity loss; understand the impact of climate change on internal and external migratory processes and build scenarios; portray the relationship between climate change, trade, and competitiveness; analyze urban policies related to GHG emission and adaptation to adverse effects of climate change; understand the link between climate change and desertification.

The most vulnerable economic sectors in this sub-region are: Forests, Agriculture, Energy, Water, Health, Environment, Urban Areas, Tourism, Fisheries.

In all research endeavors, five key methodological approaches are recommended: learning from local communities; inter-discipline; comparable methodologies; networking through different scales; combining top-down and bottom-up.

3.2.5 Brazil: Third National Environmental Conference

For more than a decade, Brazil has taken the lead in the region in several actions and policies that relate to climate change. In 2007 a high level inter-ministerial Committee on Climate Change was created, integrating several sector institutions and departments (ie. Water agency, ANA); associations of the corporate sector have joined forces to develop a Plan for Greenhouse Gas Emissions; academia – through private and public research centers – has invested in important studies to better understand the potential impact of climate change in Brazil and the continent.

Measures such as the construction of hydroelectric plants, methane production for vehicles, and stronger policies for the sustainable use of forests have been designed and put into effect in the last years. However, main actors in Brazil are still concerned about the impact of existing and/or lack of policies to address practices that affect the capacity of the country to respond to the impacts of climate change, especially in the most vulnerable regions and human settlements.

Between May 7 – 11, 2008 Brazil held its 3rd Environmental Conference led by the Ministry of the Environment. The main topic for this conference was Climate Change; the agenda also invited participants to contribute to the design of a Policy and a National Plan to address climate change in the country.

This was a good opportunity to learn about the main concerns, challenges and initiatives of the main sectors of Brazilian society: government (local and national), civil society, private sector, academy, indigenous peoples, local communities (including fishermen) and media. Projects and policy proposals were presented during these events characterized by ample participation (1200 delegates) from all regions of Brazil.

Some highlights related to research needs were:

- Impact of climate change in the north-eastern region of the country where dry-lands are already showing signs of desertification;
- Environmental indicators for different ecosystems;
- Measurement of carbon emissions due to deforestation and unsustainable agricultural practices;
- Production of vulnerability maps;
- Increase and dissemination of information on Early Warning Systems;
- Water efficient technologies for urban constructions and agricultural irrigation;
- Policies to reduce fragmentation of ecosystems;
- Analysis of the sustainability of present economic growth;
- Waste management technologies and centers.

The Ministry of Environment has received the results of the Conference as a recommended Action Plan and has committed the necessary resources to implement as many of the recommendations as possible. A more detailed description of the Conference can be found in Annex III.

3.3 Bottlenecks identified in multi-sectorial consultations

Bottlenecks in dissemination, access to, and use of information in Latin America and the Caribbean pose a serious risk to an investment in a new research program. Accordingly, these constraints should not be treated as peripheral to the science and development but should be an object of global change research (Tiessen, 2008).

Researchers in the Region have produced relevant information that, if properly used, could guide governments, the private sector and local communities in their path towards adaptation. Yet, this has not happened so far. IDRC and DFID need to take current bottlenecks into account if their investment in production of additional information is expected to have any returns in terms of results.

Dissemination: The scientific community still struggles to deliver its message to stakeholders. The public opinion remains uninformed about climate change, key stakeholder communities lack basic knowledge, and communication strategies seem to be inadequate to address the knowledge lacunae in multiple audiences – schools, general public, policy advisors, decision-makers, private sector. Unfortunately, climate change is still widely perceived as an environmental problem and responsibility over policy-making has been delegated to environmental ministries or secretaries. There seems to be a growing awareness about climate change among youth, especially students, who could act as a good dissemination vehicle.

Participants in all sub-regional consultations believe scientific information would have a more effective impact if: adequate linkages between researchers and information users were established and maintained since the very beginning in a "learning by doing" process[20]; if results were translated into a user-friendly language, tailored to the needs of different audiences who are not necessarily familiar with environmental decision-making (such as transportation, agriculture, energy, health); aside from the usual alarmist data, success stories or good practices were communicated; and, if researchers could produce materials for formal education.

Marengo (2008) suggests that there is a need to prepare the young generations for a better understanding and awareness of climate change, its multidisciplinary faces, and most importantly, encourage scientists to engage in policy-making processes.

Specifically, participants have pointed out that the professional career of a scientist is built upon the amount of papers he/she can publish in prestigious, and mostly foreign, journals. Unfortunately, participants state, these journals have not usually accepted those research topics that are of most relevance to the Region. Scientists end up giving preference to their international profile rather than contributing with papers that can be of practical use to their own countries.

Natenzon (2008) recommends including the mass and community media in the dissemination process and points out that the way in which climate information is generated does not stimulate adoption of results by potential users in the agricultural sector. This has been evidenced in a social map of institutions that provide climate information in Argentina (***www.cesam.org.ar***).

Access: Those stakeholders who intend to get hold of useful information to make decisions regarding adaptation to climate change often face numerous obstacles. The following were mentioned recurrently during sub-regional consultations.

A severe lack of coordination and information sharing between local, national and international agencies, both from the public and the private sectors, results in duplication of efforts and consequent loss of resources. Costs of access to information are usually high, especially regarding data produced abroad. Also, competition between research institutions is hindering possibilities for regional cooperation. Personal and institutional jealousy has frequently blocked access to databases useful for decision-making. Many government institutions, though obliged by freedom of information acts, demand a fee to access public existing information and/or exercise power by holding information that would identify them as key spokespersons for national and international forums.

Data is dispersed and there are no access-free databases, with updated, user-friendly, complete quality information. Few networks aggregate monitoring data obtained at the local level. Local communities could make good use of Information and Communication Technologies (ICT) to learn about good practices but their access to these technologies is only incipient. Finally, available information needs to be presented in a friendlier language for different audiences.

According to Max Campos (2008), in the area of water resources there are other major bottlenecks. The cost of implementing networks for "systematic" observations and monitoring, for gathering and transferring, for processing for quality control and for making them systematically available is very high. Also, private companies are being handed water administration in different cities making it more difficult to access the information. In those countries where monitoring networks are public, very little investment is made for maintaining them operating with the necessary quality for robust research. Yearly operating costs for the hydro meteorological network of the Instituto Costarricense de Electricidad (ICE) are estimated in US$2 million. These investments will continue as long as these networks serve the purposes of the sector.

Use: Information on key factors is still needed to develop adequate strategies and plans. However, most decision-makers in the region are not used to making decisions based on sound scientific information. Actually, there is a mismatch between the long term view of the science community and the short term view of politicians. Many governments mistakenly perceive climate change policies as a threat to economic growth and allocate very few resources to it. For example, climate change offices in the Andean Countries are focused on mitigation and almost entirely depend on the support of the international community.

Unfortunately, as a general rule, governments seems to have only opened space for cooperation with the private sector as a legitimate partner to address climate change but little has been done to incorporate existing knowledge and capacities in NGOs and community-based organizations.

For government officials to use scientific information, a shift needs to be made in the way it is presented to them. Summaries for decision-makers need to be produced for each policy-relevant paper, finding the right ways to present a political-case for long term investments. Also, some participants recommended that the challenges and implications of climate change should be addressed within a national sustainable development planning framework to facilitate the required inter agency - cooperation and more policy coherence.

Most importantly there is a need to better understand the interlinkages between science and policy, the factors that contribute to hinder or facilitate this interaction, and the mechanisms that could be put in place to allow for social and institutional learning. Social and institutional learning is a mechanism inextricably linked to the capacity for change that a society can have to adapt to a changing environment (Marengo, 2008).

At the local level, it is necessary to come up with models to integrate adaptation to climate change into development agendas although some examples are already underway: the Township of Moreno in the Province of Buenos Aires, Argentina, has produced a participatory map of vulnerability as a means to create resilience capacity. The City of Quito is currently putting together a local strategy to deal with climate change.

There is no culture of interdisciplinary or cross-sectorial dialogue that could allow for adequate linkages between climate, social, and economic studies. In the best case scenarios, different texts prepared separately without common analysis are pasted together without sufficient efforts to achieve integrated assessments. There is a strong need to create the necessary cross-sectorial translations for a fruitful dialogue between social and physical sciences. For example, if we state that a region will experience water scarcity, we should be able to clarify what this means in terms of health and in changes of public expenditure.

Finally, existing information is shaped by different incompatible methodologies, especially regarding economic costs of climate change. If countries in the Region expect to hold fluent dialogue processes, both regionally and internationally, scientists need to guarantee coherence between methodologies. There is a need for defining or adopting common climate change scenarios and methods to define vulnerability criteria, so maps at national and regional levels can be prepared. (Marengo, 2008)

20. The IPCC is conducting studies in the Andean Sub-Region on climate change and agriculture in partnership with local communities. This is consistent with Cecilia Conde's proposition (please see section 2.1) and with section 2.3

3.4 Research capacities

Existing research capacities in the Region are sufficient to launch a new research program but need to be strengthened if they are to fill the knowledge and information gaps outlined above.

LAC countries, in general, do not have a knowledge management culture and, except for a few cases, they have not put in place research promotion policies. In the case of climate change, little information has been produced on the economic costs of adaptation, hindering the chances of success of awareness-raising efforts among policymakers and private sector representatives about the magnitude of threats associated with climate change. Consequently, insufficient local public and private financial resources have been allocated for further research, resulting in internationally driven agendas that do not necessarily respond to all information needs for decision-making.

Only now that impacts have become more visible and that international communication strategies have successfully delivered a more powerful awareness message, might research costs be considered by private companies as an investment rather than as low priority expenses. For example, shrimp farms in Ecuador now seem to understand how they could have reduced costs related to climate change had they seen the importance of adaptation.

In spite of these limitations, FFLA believes that sufficient research capacity is available in LAC to undertake new research to address the key information and knowledge gaps outlined in section 3.1. This belief is grounded on the information obtained from participants and sub-regional partner organizations during the consultation process regarding existing capacities and ongoing research initiatives. The following table presents a summary of this information in an effort to point out where there might be gaps in capacities and initiatives. Although we believe it outlines quite accurately gaps and strengths in research capacities and provides an indication of potential partners for a research program, we need to emphasize that, due to time constraints, we might have overlooked other relevant institutions. Also, it is worth noting that we have only included a few Brazilian institutions mentioned during the Southern Cone consultation but no additional effort could be made to undertake a more comprehensive assessment of research capacities and initiatives in Brazil.

Table 7. *Research capacities in LAC*

Research Needs	Caribbean	Andean Sub-Region	Mesoamerica	Southern Cone
Economic impact of climate change and costs associated to adaptation options	- CARICOM Climate Change Center - Caribbean Disaster Emergency Response Agency (CDERA) - Caribbean Agricultural Research Development Institute (CARDI) - UN Food and Agricultural Organization (FAO)	- Universidad del Pacífico Research Center (CIUP). - Secretary General to the Andean Community (CAN): Andean Regional Adaptation Project in Bolivia, Ecuador, and Peru, funded by GEF-World Bank - Instituto de Estudios Peruanos (IEP)	There are several studies, many of them produced by CEPAL, on the value of disasters applied to these areas, where there are indications that approximately 85% of the disasters are climate related.	- Instituto Nacional de Tecnología Agropecuaria (INTA) (Argentina) - Instituto Nacional de Investigación Agropecuaria (Uruguay) - Universidad de Buenos Aires (Argentina) - Fundación Bariloche, Environment and Development Program - Universidad de Chile, Facultad de Ciencias Agronómicas. - Centro Latino - Americano de Ecología Social (CLAES) (Uruguay) - Economics of Climate Change Project, funded by the World Bank and the UK government, to estimate the cost of climate change (Brazil). Preliminary results are not yet available.
Downscaling climate change scenarios	- University of West Indies - Instituto de Meteorología (Cuba)	- Universidad Simón Bolívar Centro de Estadística y Software Matemático (CESMA) (Venezuela) - IGP: Climate Change Scenarios (Perú) - INAP, IDEAM (Colombia)	- Cathalac – Servir (UNDP) (NASA/USAID) - INE (Mexico) - Universidad de Costa Rica –CIGEFI - CEPAL and the Central America Integration System (SICA) are including climate change scenarios in their action plans for implementing their renewable energy expansion.	- CPTEC-Centro de Previsao e Estudos Climáticos de INPE (Instituto Nacional de Pesquisas Especiais) - Centro de Previsão de Tempo e Estudos Climáticos, Instituto Nacional de Pesquisas Espaciais (Brazil) - Centro de Estudios Avanzados en Zonas Aridas (CEAZA). - Centro de Investigaciones del Mar y la Atmósfera (CIMA) – (Argentina) - Universidad de Buenos Aires (UBA), Special Research Program on Climate Change (PIUBACC). - Universidad Nacional de Asunción, Facultad de Ciencias Exactas y Naturales (Paraguay) - Universidad de Chile, Departamento de Geofísica. - Universidad de la República, Facultad de Ciencias (Uruguay)
Early warning systems	- Caribbean Disaster Emergency Response Agency (CDERA)	- INVEMAR (Colombia), National Pilot Project on Adaptation related to sea-level rise, funded by World Bank-GEF. - Servicio Nacional de Hidrología y Meteorología (SENAMHI) (Perú)	- Cathalac – Servir (UNDP) - SNET y MARN(El Salvador) - Universidad de Costa Rica, Escuela de Matemáticas y Física. - Universidad de Costa Rica, Centro de Investigación Geofísica.	- Universidad de Chile, Departamento de Geofísica. - Pontificia Universidad Católica Argentina (UCA), Research Program on Atmospheric Processes in Global Change. - INPE has over the past years gathered a lot of experience in promoting good quality, open access Geographic Information Systems including open source software.
Fisheries	- CARICOM Climate Change Centre, Adaptation Measures in Coastal Zones (SPACC Project) - University of the West Indies, Centre for Resource Management and Environmental Studies (UWI – CERMES) - Institute of Marine Affairs (Trinidad and Tobago) - Organization of Eastern Caribbean States (OECS) - Buccoo Reef Trust (Tobago)	- IDEAM (Colombia), National Pilot Project on Adaptation (World Bank-PHRD-IDEAM): Water and Carbon Cycles monitoring systems in high mountains and glaciers. - IDEAM (Colombia) - National Pilot Project on Adaptation (World Bank -MRI-IDEAM): Climate Change Scenarios (25x25km) - National Pilot Project on Adaptation (World Bank-GEF-IDEAM): local CC scenarios, network of 157 weather stations, capacity-building.		

Research Needs	Caribbean	Andean Sub-Region	Mesoamerica	Southern Cone
Tourism	- CARICOM Climate Change Centre - Caribbean Disaster Emergency Response Agency (CDERA) - Caribbean Tourism Organization (CTO)			
Food security	- University of Trinidad and Tobago (UTT)	- MDS-OCC (Bolivia) – UNDP: Project on Vulnerability and Adaptation to CC and VC in food systems of arid and semiarid mountain areas. - Instituto Nacional de Investigación Agrícola (Venezuela): crop adaptation	- FBIS/HIVOS: Sustainability Monitoring Network	
Vulnerability Maps		- GEF - UNDP Project: National Communications to the UNFCCC - INVEMAR (Colombia): Dutch Program on Climate Change: Vulnerability in coastal areas - The IDRC integrated Environmental Municipal Management Approach (SIGA), Social and economic mapping, applicable in Central America, Andean and South America Municipal areas of small and medium sized cities.	- SICA/CCAD - Autoridad Nacional Ambiental (Panamá) - ECLAC: Environmental, social and economic vulnerability mapping.	- Centro de Estudos Integrados sobre Meio Ambiente e Mudanzas Climáticas (Brazil) - Universidad de Buenos Aires (Argentina) - INPE, Centro de Previsão de Tempo e Estudos Climáticos (Brazil)
Agriculture	- CARICOM Climate Change Centre; Mainstreaming Adaptation to Climate Change (MACC) Project - Caribbean Agricultural Research Development Institute (CARDI) - UN Food and Agricultural Organization (FAO) - National Agricultural Research Institute (Guyana) - University of Trinidad and Tobago (UTT) - Guyana Sugar Corporation - University of West Indies (UWI)	- ANDES (Peru): Adaptation in the Potato Park. - Centro Internacional de la Papa – CIP: CC Impact on andean potatoes - COSUDE – INTERCOOPERATION: Project on Adaptation to Climate Change (Peru).	- GTZ (México y Nicaragua): Small Coffee-Farmers Adaptation to Climate Change - Universidad Nacional de Costa Rica, Centro Mesoamericano de Desarrollo Sostenible del Trópico Seco (CEMEDE)	- Universidad de Chile, Departamento de Ciencias Ambientales & Recursos Naturales Renovables, Facultad de Ciencias Agronómicas. - EMBRAPA (Brazil) - Instituto de Economía y Sociología - Centro Nacional de Investigaciones Agropecuarias (INTA) (Argentina) - Universidad de Buenos Aires (UBA) (Argentina) - Fundación para la Innovación Agraria (FIA) (Chile) - Universidad La Serena (Chile) - Universidad Austral (Chile) - Universidad de la Serena (Chile) - Centro de estudios avanzados en zonas áridas (CEAZA) - Universidad Católica, Facultad de Ciencias forestales (Chile) - Universidad de Chile, AGRIMED - Pontificia Universidad Católica Argentina (UCA), Programa de Estudios de Procesos Atmosféricos en el Cambio Global. - Instituto Nacional de Investigación Agropecuaria (Uruguay) - Universidade Federal de Vinosa, Departamento de Engenharia Agrícola (Brazil) - Universidad de la República, Facultad de Ciencias (Uruguay) - Centro Latino Americano de Ecologia Social (CLAES) (Uruguay)

Research Needs	Caribbean	Andean Sub-Region	Mesoamerica	Southern Cone
Health: correlation between climate change and the spread of vector-borne and other diseases.	- Caribbean Environmental Health Institute (CEHI) - Pan American Health Organization (PAHO) - Caribbean Epidemiology Centre (CAREC): Assessment of Impacts and Adaptation to Climate Change in Human Health in the Caribbean - University of West Indies (UWI)	- Organismo Andino de Salud - Instituto Nacional de Salud, focused on reduction of health vulnerability to CC (dengue and malaria)	- Instituto Nacional de Salud Pública, Cuernavaca, México - Universidad Nacional Autónoma de México, Facultad de Medicina. - Universidad Autónoma de Torreón, Fac. de Medicina, México	- Cruz Roja Argentina - Fundação Oswaldo Cruz (Fiocruz) (Brazil)
Water management	- CARICOM Climate Change Centre - Caribbean Institute of Meteorology and Hydrology (CIMH): Caribbean Water Initiative - Caribbean Environmental Health Institute (CEHI): Rainwater Harvesting - Caribbean Natural Resources Institute (CANARI) - Institute of Marine Affairs (Trinidad and Tobago) - CARICOM Secretariat: Drip irrigation project - UNEP Caribbean Environment Programme	- Universidad Central de Venezuela, Instituto de mecánica de fluidos: Hydrologic modelling of rainwater in mountain slopes. - IRD (Perú): Monitoring of water supply from glaciers. - Proyecto MASAL (Ministry of Agriculture of Perú and Swiss Development Cooperation) in Cusco and Apurimac: Adaptation project to protect and manage water in rural poor areas. - IPROGA-ITDG (Perú): Water Conflict Management - Instituto Geofísico del Perú: River-basin integrated assessment - CONAM and SENAMHI (Servicio Nacional de Hidrología y Meteorología) (Perú): River-basin integrated assessment - Intercoperacion-PREDES-LIBELULA (Perú): CC Adaptation Program in Cusco and Apurimac, on desertification and reduction in water supply. - World Bank-SCCF Project on Glacier Retreat in Central Andes (Bolivia, Ecuador and Perú) (in process of approval). - IRD-Escuela Politécnica-INAMHI(Ecuador): Glacier Retreat. - WWF/TNC/UNAL, KCL (Brasil, Colombia, Ecuador, Peru, Bolivia, Venezuela): ecosystem vulnerability and poverty. - ECOCIENCIA (Ecuador) and CIP (Perú, Ecuador, Colombia): "páramos" vulnerability	- Universidad de Costa Rica: underground water suppy - A study on demand projections for three time horizons in Central America, made by CRRH, IUCN and GWP	- Universidad Católica de Chile, Facultad de Cs forestales. - Universidad de Concepción, Centro de Ciencias Ambientales EULA-Chile, - Universidad de Chile, AGRIMED - Centro de Estudios Científicos (CECS) – Valdivia, Chile - Universidad La Serena (Chile) - Instituto de Ecología y Biodiversidad (IEB) - Universidad de Buenos Aires (Argentina) - Universidade Federal de Vinosa, Departamento de Engenharia Agrícola (Brazil) - Universidad de la República, Facultad de Ciencias (Uruguay)

Research Needs	Caribbean	Andean Sub-Region	Mesoamerica	Southern Cone
		- IDEAM (Colombia): National Project on Adaptation (World Bank, GEF, IDEAM) on vulnerability of Chingaza "paramos" - Invemar-Coralina: National Pilot Project on Adaptation (World Bank-GEF-INVEMAR): water availability in insular zones.		- Universidad de Chile, Facultad de Ciencias Agronómicas, Departamento de Ciencias Ambientales & Recursos Naturales Renovables. - Fundación Moisés Bertoni (Paraguay) - Universidad de la República, Facultad de Ciencias, Sección Oceanología (Uruguay) - Universidad Austral (Chile) - Universidad Católica de Chile, Facultad de Ciencias Forestales - Centro de estudios avanzados en zonas áridas (CEAZA) - Universidad de la Serena (Chile) - FORECOS (Chile) - Universidad de Buenos Aires (UBA), Facultad de Filosofía y Letras, Instituto de Geografía, Programa de Investigaciones en Recursos Naturales y Medio Ambiente – PIRNA.
Ecosystem resilience	- UWI – CERMES - Caribbean Environmental Health Institute (CEHI) - Caribbean Natural Resources Institute (CANARI) - UNEP Caribbean Environment Programme - UWI - St.Augustine campus - Instituto de Ecología y Sistemática (Cuba)	- WWF (Perú):Vulnerability of High Mountain Ecosystems - IVIC-LP-DV (Venezuela): Vulnerability of Ecosystems in the "llanos" of the Orinoco. - INVEMAR: National Pilot Project on Adaptation (World Bank-GEF-INVEMAR) for coastal ecosystems. - Eco Portal.NET - Instituto de Investigación de Recursos Biológicos Alexander von Humboldt (Colombia) - Universidad de los Andes, Instituto de Ciencias Ambientales y Ecológicas (ICAE), Mérida, Venezuela. - Escuela Politécnica Nacional, Centro de Investigación Científica y Tecnológica (CIIFEN) (Ecuador)	- Centro Agronómico Tropical de Investigación y Enseñanza (CATIE) and Center for International Forestry Research (CIFOR):TROFFCA Project on Forests and Adaptation - WWF (Belize, México, Guatemala, Honduras): Coral reef monitoring - Universidad de Costa Rica and REDICA: coastal erosion and sedimentation - Universidad Zamorano (Honduras)	- Pontificia Universidad Católica Argentina (UCA), Research Program on Atmospheric Processes in Global Change - Universidad La Serena (Chile) - Universidad Nacional de La Plata, Facultad de Arquitectura y Urbanismo (Argentina) - Fundación Bariloche (Argentina) - Instituto Nacional de Pesquisas Espaciais (INPE), Centro de Previsão de Tempo e Estudos Climáticos (Brazil) - Universidad de Chile, Facultad de Ciencias Agronómicas
Governance: new institutional arrangements for decision-making on climate change	CARICOM Climate Change Centre	Fundación Futuro Latinoamericano (FFLA)		
Alternative energy programs	CARICOM Secretariat: Caribbean Renewable Energy Development Program		- ICSU: Energy, Biodiversity and Natural Disasters - Energy and Environment Alliance (El Salvador) - Universidad Zamorano (Honduras)	- Universidad de Buenos Aires (Argentina) - Fundación Bariloche (Argentina)
House building techniques to resist colder or warmer temperatures				- Universidad de Buenos Aires (Argentina) - IIED-LA
Harnessing Traditional Knowledge to cope with CC	- PANOS Caribbean - Caribbean Development Bank	- Universidad Nur, Procavi (Bolivia) - Proyecto MASAL (Perú)		

According to this Table, most of the sub-regions do have institutions and capacities to undertake research projects that can help bridge some important knowledge and information gaps. Research institutions from Brazil (mainly in Sao Paulo and Rio de Janeiro), Argentina, Chile (mostly focused on agriculture), México, Costa Rica, Panama, Colombia, and Peru, as well as Caribbean Regional organizations seem to hold the best research capacities in climate, social and economic studies. However, they are not producing integrated assessments except for some incipient exceptions.

Certainly, there are differences in capacities among sub-regions. While the Andean countries seem to have special capacities to conduct research on water or on health, the Southern Cone seems to be taking the lead in research capacities regarding agriculture. The Caribbean sub-region, including the Colombian-Caribbean, appears to have more capacities regarding fisheries, tourism, and coastal management.

All sub-regions seem to have similar capacities to undertake research on ecosystem resilience. All the same, and despite the importance of biodiversity to the whole Region, in the words of Avelino Suárez (2008), there is limited information on the link between Climate Change and Biodiversity. Most sub-regions do seem to have the capacity to develop climate change scenarios and downscale them as much as methodologically possible.

We encountered few organizations from the social sciences field working explicitly on new institutional arrangements for decision-making on climate change. There are important institutions developing a body of knowledge on good governance for sustainable development that are slowly turning their attention towards adaptation to climate change. In other words, the capacity on governance issues is there but needs to be channeled towards climate change.

Similarly, we are only witnessing the first steps towards producing solid information on economic impacts of climate change and costs associated to adaptation options, as well as on vulnerability maps. We do not believe this is due to a lack of capacities. Rather, the good existing capacities have not been used, due to insufficient funding opportunities to undertake this kind of research and lack of interest from policy-makers. This seems to be changing.

In all consultations, participants have reported difficulties in terms of human resources management for sustained research. They have all expressed their concern about the lack of a critical mass of researchers focused on climate change. In response to this, participants have expressed the need to put together a Scholarship Program on Climate Change for graduate and post-graduate studies. They have also suggested the importance of establishing strong inter-regional networks to allow for experts to provide their services in different countries, thus coping with human resources limitations. INPE-CPTEC of Brazil, CATHALAC in Panama and the IAI are promoting such activities (Tiessen, 2008). In the Andean Region, participants expressed the need to increase the amount of meteorologists and their capacity to interact with local communities to systematize information on climate change.

In all regions, most research endeavors are conducted with funding from international development cooperation, concentrate on deforestation and CDM, and professional teams are built ad-hoc. Once the specific project is over, there is no institutional platform that can provide support for continuity of the team. In government institutions, high rotation of key people deteriorates their capacity to maintain a critical mass of specialists in climate change. In any case, human resources difficulties need to be part of the central focus of a research Program.

As expressed in sections 4 and 5.2, energy has been an important gap in the process. There are research capacities in the region to address it as well but they have not been assessed during the consultation process.

Finally, we must turn our attention to organizations that can undertake regional initiatives with common methodologies and frameworks across countries, often signaled as a priority need in this report. Some of these organizations, mentioned by participants and expert reviewers, could be:

- The Association of Universities of the Montevideo Group (AUGM) has been in operation since 1991 as a result of an Agreement of Universities from Uruguay, Paraguay, Chile, Brazil, Bolivia and Argentina (***www.grupomontevideo.edu.uy***). The Group addresses complex issues with a multi-disciplinary approach and could take up adaptation to climate change as a research priority.
- Binational Cooperation Agreements on Science and Technology, as the one signed between Brazil and Argentina (MINCyT-CAPES);
- Multinational cooperation agreements on research, science and technology that gather research centers, such as the Inter-American Institute for Global Change Research (IAI) or International Human Dimensions Programme (IHDP) on Global Environmental Change, which has national committees in Argentina, Bolivia, Brazil, Costa Rica, Chile, Ecuador, México and Venezuela.
- UNESCOs PccP on water conflicts (***www.unesco.org.uy/phi/pccp***).
- Latin American networks of academic centers, such as the Latin American Council of Social Sciences (CLACSO) or the Latin American Faculty of Social Sciences (FLACSO).
- The Economic Commission for Latin America and the Caribbean (ECLAC / CEPAL) under the UN Framework.
- Other non-governmental research centers on social issues in Latin America, such as the Network of Social Studies on Prevention of Natural Disasters in Latin America (***www desenredando.org***), which has been working since1992 involving associate centers in Costa Rica Buenos Aires, México, Quito, Lima, Cali, Panama y Paraiba.
- FLACMA. Latin American Federation of Cities, Municipalities and Associations and respective sub-regional associations and Federations.

3.5 Consultation with vulnerable communities

In this section, we present the results of separate consultations with vulnerable communities described in section 2.3 of this report. We first present common concerns and knowledge gaps mentioned by community representatives in LAC and then outline specific additional needs per sub-region.

3.5.1 Common concerns and knowledge gaps across sub-regions

Despite the differences between communities interviewed under this initiative, there is a surprising coincidence in the kind of needs they have expressed. In general terms, while most communities do not fully understand the meaning and potential impacts of "climate change" or "global warming", they all share the perception that significant and rapid changes are taking place in weather patterns and the concern to find ways to adapt to this new reality. Mitigation is far from a priority for them.

We believe it is useful to classify the needs of vulnerable communities into three categories, namely information, practical adaptation, and institutional capacities.

Table 8. *Needs expressed by vulnerable communities*

Information needs:	
a)	All rural and some urban communities have expressed the need for local climate change scenarios and early warning and prevention systems that can be operated by them, with good quality meteorological information on winds, rain, tides, submarine currents, sea-level, etc. Information on projected impacts on water availability, agriculture, and infrastructure is highly valued.
b)	Communities would welcome formal and informal education initiatives that can effectively inform both civil society and public authorities about climate change causes and impacts, using simple and friendly language, as a step towards obtaining true commitment to respond. Capacity building to design their own adaptation strategies is very important.
Practical adaptation needs:	
c)	Alternative farming methods, both in agriculture and fisheries, which can better adjust to climate variations, are being sought.
d)	As increased droughts are an expected part of the climate change phenomenon, agricultural communities need to enhance their capacities for watershed management, with specific interest in efficient irrigation, and rainwater management.
e)	Rural communities request support to design alternative livelihoods, find new sources of income, or create jobs at a larger scale.
f)	Some members of vulnerable communities have resorted to migration as a spontaneous adaptation mechanism. Government planned relocations are seen as an option both by rural and urban communities.
g)	There seems to be an important baggage of traditional knowledge, potentially useful to improve resilience and adaptive capacity of the population and productive systems, which needs to be harnessed.
h)	An increasing concern about the upsurge of new, or long-gone, diseases has lead to demands for immunization to and prevention of diseases brought by heavy rainfalls and flooding.
i)	Alternative energy programs and house building techniques to resist colder or warmer temperatures have also been recurrently mentioned as needs.
Institutional capacity needs:	
j)	Communities value territorial, land-use and contingency plans as the right tools for decision-making, yet they have expressed serious concerns regarding insufficient planning capacities in state institutions and limited opportunities for multi-stakeholder participation with a bottom-up approach.
k)	Most, importantly, community value social cohesion and organizational development as a key asset to successful adaptation. They believe in information networks and community team-building and state that various stakeholders from different fields need to come together.

It should be noted that some needs expressed by vulnerable communities aim at very concrete actions, such as infrastructure development or irrigation projects. And, certainly, these should be primarily addressed by public or private investment. A research program could only bring in some knowledge on some aspects of these needs.

In the following sections, we present a summary of findings corresponding to each of the sub-regions. More detailed information is contained in each of the sub-regional reports, attached to this document as Annexes.

3.5.2 Caribbean Sub-region

Additionally to the needs expressed in Section 3.5.1, communities have mentioned the following:

- In coastal communities, there is a specific need to understand patterns of sea-level rise causing marine intrusion and salination of ground water;
- Awareness-raising, training and capacity building programs around disaster mitigation -that include first-aid, search and rescue techniques, and management actions (infrastructure, retaining walls, etc)- need to be put in place;
- Agriculture and fisheries: Communities would like to know if governmental subsidies and incentives can play a positive role in this direction and if value-added processing at a community-level can be encouraged and enabled. Also, technical support to design and implement sustainable fisheries management would be welcome;
- Water management: A specific request was made to assess feasibility of tanks and cisterns for water capture and storage;
- Alternative energy supply: Community members requested information on solar heating; and
- Alternative livelihoods: Communities would like to know if there are ways of making available financial incentives to owners of mountainous lands for the setting up of agro-forestry programs.

3.5.3 Andean Sub-region

In addition to the needs expressed in Section 3.5.1, communities have mentioned the following:

- Changes in economic activities are being pursued either to strengthen their adaptive capacity or to switch to new sources of income. Farmers are experimenting with new different ways to sow crops. An example of this can be seen in Santa Elena(Ecuador), where short term crops are being planted in two phases: a) first, the seeds are planted and the crop grows to a certain stage; b) then, it is replanted into a different soil to prevent it from suffering dehydration or other damages due to heat and drought. They are also modifying the types of short cycle crops to adapt them to water stress and higher temperatures and would need to learn about the feasibility of new crops. Fishermen are either in need of alternative jobs or information about marine currents to determine which fishing techniques can be used to be more successful.
- Water management: Communities would like to know how to build water reservoirs in higher zones and implement more efficient irrigation techniques in lower areas;
- Traditional knowledge for adaptation: Traditional mechanisms to prevent flooding in coastal areas are being studied as potential low cost strategies to adapt to climate change;
- Alternative energy programs and house building techniques to resist colder or warmer temperatures have also been mentioned as needs; and
- Communities would like to know if there are potential benefits of climate change.

3.5.4 Mesoamerican Sub-region

In addition to the needs expressed in Section 3.5.1, communities have mentioned the following:

- Training programs should strengthen the capacity of communities to plan their own adaptation strategies;
- There is a need to understand and quantify the dependence of communities on ecosystem goods and services, and assess how both climate change and potential adaptation strategies could impact their sustainability.
- Integrated water management: micro-basin management is seen as the most appropriate scale to work to involve the participation of local communities. Under this framework, efforts to strengthen infrastructure capacities (bridges, dams, etc.) should also be encouraged.
- Communities who depend heavily on agriculture would like to expand irrigation areas and to receive incentives for technological change towards more rational water and energy consumption. Yet, they point out that adaptation strategies should build on the effectiveness of traditional knowledge.
- Other priorities expressed by communities are:
  - *Immunization to and prevention of diseases brought by heavy rainfalls and flooding.*
  - *Creation of a food reserve (basic grains) for emergency situations.*
  - *Improvement of infrastructure needed to deal with emergency and disasters, especially bridges.*
  - *House building techniques to resist colder or warmer temperatures.*
  - *A stronger will to enforce regulations regarding environmental conservation, construction, and waste management.*

3.5.5 Southern Cone sub-region

In addition to the needs expressed in Section 3.5.1, communities have mentioned the following:

- In urban communities, awareness-raising for poor communities on where to locate their houses is seen as a priority;
- There is a need for improved water management techniques, especially low-cost irrigation technology and reservoirs. Communities urgently need alternative sources of energy that can cover the scarcity of hydroelectricity due to water shortages and continue powering water pumps and communication facilities;
- Farmers have tried to select new breeds of cattle that can be more resistant and productive but have faced prohibitive costs. However, some community members warn that change takes time and that older farmers tend to refuse to abandon their practices. Change is usually promoted by younger generations but this is only possible in communities where they have not migrated;
- Communities would greatly value the possibility of learning from successful practical experiences of adaptation to climate change in other parts of the world facing similar challenges. Similarly, they are willing to initiate pilot projects with more resistant crops and, if successful, replicate their experience. They state they would benefit from knowing which institutions to resort to in their search for practical solutions;
- In urban areas, adaptation has been happening spontaneously in very different ways. Extreme poverty has driven many people to build their fragile homes in flooding-prone areas, even though they were warned of the risks they were facing. Some of them leave their homes when extreme events happen and return when it is over. Others try to build two-storey houses. Some others demand help from state institutions and they may get relocated to other places. Surprisingly, they sometimes sell their new homes because they need the money and return to the houses they had abandoned;
- Communities believe that state institutions should be their main partners in their quest towards adaptation, especially those that depend on agriculture. There is a strongly felt need for adequate and smooth coordination between all stakeholders, with clear accountability mechanisms and active participation of grassroots organizations. Currently, poor communication between state institutions and local communities results in ineffective, unplanned, and improvised actions.

3.6 Findings of the literature review process

3.6.1 Data base

Sub-regional partners completed their literature review process uploading references to formal and informal documents to the Refworks database hosted by IDRC. For each of the documents, a very brief summary was produced to facilitate search and access for users. Most documents are in a full digital format and others, in print version, are only referenced.

While the project was being undertaken, a large number of new documents were being produced. It is, therefore, likely that, by the time this report is presented, new information will be available but not uploaded in the Refworks database.

Caribbean

In total, 190 references were collected for this database. Based on the compilation, there is a paucity of peer-reviewed, published literature on climate change in the Caribbean region. Overall, 41 journal articles were sourced, with the highest number being in the area of climate change and biodiversity. This is partly due to the large amount of research on coral reefs and coral reef bleaching events.

The grey literature (unpublished reports) was more extensive when compared to the referred articles. Most are reports on the outcome of conferences and workshops. Other works referenced are thesis from University of West Indies' MSc. in Climate Change. Policy-related literature and adaptation studies and projects are mainly from the Caribbean Planning for Adaptation to Climate Change (CPACC) and Mainstreaming Adaptation to Climate Change (MACC) projects. There are also some reports on disaster mitigation, health, food security and agriculture and energy related studies such as alternative energy initiatives and clean development mechanisms.

In terms of research and initiatives being carried out in different countries of the Caribbean, there seems to be a disparity, with some countries, such as Barbados and Guyana, having a higher number of climate change activities/projects in all areas when compared to other countries such as Cuba and Haiti.

There is a recent document on costs of impact of climate change. "The Caribbean and Climate Change: The Costs of Inaction" is a study by Ramón Bueno, Cornelia Herzfeld, Elizabeth A. Stanton, and Frank Ackerman, researchers in the joint GDAE/SEI-US Climate Economics program, at Tufts University, which was commissioned by the Environmental Defense Fund (EDF).

Andean Region

Approximately 250 references were found for the Sub-region, 80% of which have been fully uploaded and the remaining 20% is available in print format. More than 70% of the documents are written in a scientific-technical language and the rest are published as bulletins or books for friendly dissemination. 60% of the documents are in Spanish, 30% in English and 10% in Portuguese.

There is insufficient dissemination of research produced by academic institutions. Pre and post graduate thesis are either inaccessible or have not been digitalized. NGOs in Ecuador, Peru and Bolivia have produced relevant research pieces. Unfortunately, they do not publish final reports of their initiatives that could help to access lessons-learned or plan for replication. The private sector has only commissioned research for its own specific needs and has not invested in basic research. Multiple conferences, seminars, workshops on climate change are taking place in the sub-region. Finally, there is an interesting regional initiative between Ecuador, Peru and Bolivia called Andean Regional Climate Change Adaptation Project (PRAA), focused on high-mountain ecosystems. In contrast, studies about the Amazon region have been fragmented into single countries without any collaborative multi-national initiative.

There is a good amount of information on future climate conditions and potential effects. Plenty of attention has been paid to glacier retreat, especially in Peru. Coastal management, water resources, territorial planning, risk and disaster management are some of the issues that are being addressed regarding adaptation to climate change.

Except for a very few documents, there are important information gaps regarding the link between climate change and biodiversity, health, economic activities (such as agriculture, mining, tourism, silviculture, or fisheries), and energy. Little has been produced on socio-economic vulnerability and no information could be found on vulnerability of indigenous people in the sub-region. Except for a recent, and very preliminary, study by the Andean Community (CAN)[21], there is no emphasis on cost-estimation of predicted climate change impacts.

21 *Secretaría General de la Comunidad Andina, "El Cambio Climático no tiene fronteras. Impacto del Cambio Climático en la Comunidad Andina." http://www.comunidadandina.org/public/libro_84.htm Mayo, 2008.*

Mesoamerica

A total amount of 80 articles published in scientific journals has been incorporated to the data base. Most of the scientific efforts on climate change have focused on biodiversity loss, especially regarding reptiles, insects, and on coral bleaching.

Most of the research is led by international research institutions in partnership with local organizations, except for Centro Agronómico Tropical de Investigación y Enseñanza (CATIE) and Organización de Estudios Tropicales (OET) in Costa Rica, and the Smithsonian Institute in Panama.

CATIE and OET have produced literature on climate change mitigation and tropical forests, seemingly one of the few research initiatives on mitigation. Mexico and Costa Rica seem to concentrate most of the research initiatives. In both countries, there is incipient research on public policy on climate change, as well as on energy, transportation and adaptation strategies for rural agricultural communities (coffee).

Pre and postgraduate studies on climate change prepared in national universities end up filed in libraries and virtually inaccessible since it has not been prepared in electronic format. Through interviews with vulnerable communities we learned that certain local universities conducted applied research. Such is the case of the Universidad de Costa Rica, la URACCAN (Universidad de la Costa Caribeña Nicaragüense), CATIE y Zamorano.

Southern Cone

Most of the information obtained for the sub-region is primarily based on official declarations or studies and has also been complemented from other sources.

It should be noted that, even though available information is dispersed and not homogeneous in terms of countries and issues analyzed, it was easy to collect in Argentina and Uruguay, the only two countries in the region who have completed a second National Communication. And while Chile and Brazil also provided good information, hardly any research material was found in Paraguay.

A complete summary of findings is presented in a 90-page report prepared by RIDES.

4

Overall Conclusions and Recommendations

Overall, the outcomes demonstrate that there are major knowledge and information gaps that need to be filled promptly to proactively respond to the threats posed by climate change to Latin America and the Caribbean. A research program would certainly come at the right time to serve governments in their incipient shift of attention towards adaptation needs.

Even though each sub-region has its own specific concerns, they share certain general similarities across sectors and issues, and, therefore, common information and research needs that would allow for replication. Adaptation has been repeatedly mentioned as a priority. Mitigation was solely raised as important by private sector representatives from the Caribbean, and a few representatives from the Chilean government and academic institutions. It was also highlighted as important when linked to adaptation strategies. No other disparities or polarization across sectors were evidenced.

But, according to Tiessen (2008), these coincidences do not necessarily allow for replication of successful practices across subregions. Replication is to some degree superficial and will disappear when a more detailed analysis is applied. There is a need for clear regional differentiations and therefore for regional projects. For example, an analysis of drought effects in the different consultation regions also produces a highly differentiated picture of stressors and needs. In much of Mexico and Mesoamerica, the principal emerging drought threat are veranicos of increasing severity, dry spells during the rainy season, that have the potential to seriously affect yields of seasonally sensitive crops such as maize. In terms of climate science, adaptation to these drought events requires improved medium-term forecasting. On the other hand, areas east of the Andes in Argentina are experiencing drying trends that may be associated with either 40-50 year cycles or may represent true climate change trends. In that region, reliable downscaling of general circulation models may provide answers. The adaptation mechanisms in the two regions are similarly different, ranging from water management for emergency irrigation or crop timing in Mesoamerica, to wholesale adaptation of cropping systems and selection of species adapted to the new environmental conditions in parts of the Southern Cone.

Interestingly, the voices of interviewed members of vulnerable communities and those of the participants who attended the multisectorial workshops are quite aligned and, certainly, not contradictory. Community members do focus their attention on practical adaptation needs but also welcome applied research that can contribute to their understanding of changing weather conditions and the prevention of adverse impacts. However, their sense of urgency to tackle problems is different from academic researchers, who usually think in longer time-frames.

FFLA would, therefore, suggest that IDRC and DFID do not adopt a geographic focus for their efforts on climate change. Rather, FFLA believes that priority should be given to research initiatives with high replication potential, namely:

- Research on sectors and cross-cutting issues of common concern to all sub-regions (please, see section 3.1.1 e. and f). A successful research initiative in one of the sub-regions could produce relevant information for other sub-regions and, thus, efficiently contribute to enhancing adaptation capacities all over Latin America and the Caribbean. Considering Tiessen's warning, caution should be taken regarding replication by fully understanding sub-regional specific characteristics and needs.
- Research initiatives to downscale climate scenarios, map vulnerabilities, and assess costs of climate change impacts and adaptation. Special efforts should be made to bring grant-winning research teams together to build innovative and common methodologies that can render better and comparable results.

IDRC and DFID should mainly consider research proposals that:

- Can demonstrate early engagement of communities and/or decision-makers in the research process, right from the definition of the problem to be analyzed.
- Are submitted by an inter-disciplinary group of researchers.

Preference should be given to inter-sectorial and inter-disciplinary teams that have been working together before the call for proposals was issued. This would contribute to mitigate the risk of supporting alliances created only for the purpose of getting a grant but not necessarily motivated by previous good working experiences.

Participants have warned about bottlenecks in dissemination, access to, and use of information in all of Latin America and the Caribbean . Rather than negative risks, these should be considered as target problems to be addressed directly by the research program. For example, besides ensuring early engagement with beneficiaries, an eligible research proposal should clearly state how it expects to "translate" scientific findings into user-friendly language, tailored to the needs of different audiences who are not necessarily familiar with environmental decision-making (such as transportation, agriculture, energy, health), and how they will get involved, if necessary, in public policy discussions.

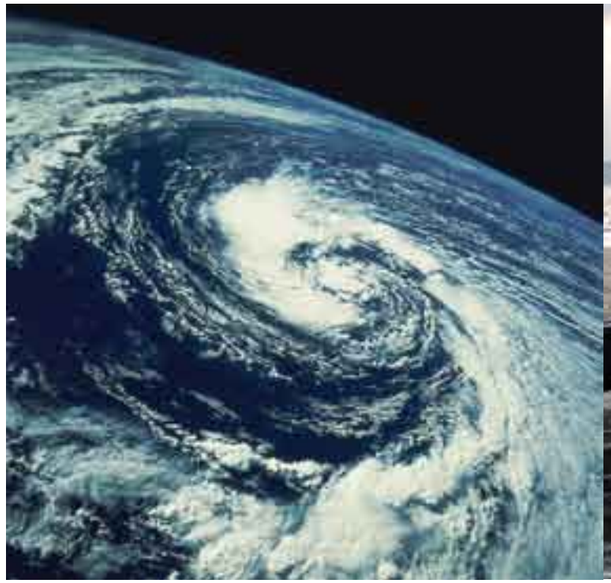
FFLA has stated that existing research capacities in the Region are sufficient to launch a new research program but need to be strengthened if they are to fill the knowledge and information gaps outlined above. In all regions, most research endeavors are conducted with funding from international development cooperation and, once the specific project is over, there is no institutional platform that can provide support for continuity of the team. In government institutions, high rotation of key people deteriorates their capacity to maintain a critical mass of specialists in climate change. FFLA would like to recommend that IDRC and DFID try to avoid repeating this negative pattern and make of this problem an issue to address in their research initiatives.

The experts' review of a draft version of this report indicates that the key findings of the consultation process are consistent with most of the existing knowledge found in literature.

The construction of a database with documents on climate change has been welcome by numerous participants. As a means to combat data dispersion, FFLA recommends that IDRC and DFID continue to update it and promote access for vulnerable populations and sectors to relevant information. Just as this project is being concluded, a large amount of new documents are being published. It is, therefore, likely that, by the time this report is presented, new information will be available but not uploaded in the Refworks database.

FFLA would like to suggest that IDRC and DFID consider putting together an Advisory Board for their programs, integrated with recognized members of vulnerable communities and sectors, researchers, governments, and local authorities, linked to the research projects, which could meet annually to assess impact of the program and provide ideas for further research. Following up with recommendations made by participants, it would be convenient to include young people in the Advisory Board, as well.

Accordingly, a knowledge management mechanism that would allow for early systematization of tools and methodologies developed by projects under the program should be put in place to aim at obtaining comparable results and replicating successful experiences.



5

Appraisal

Overall, the consultation process has resulted in a comprehensive formulation of stakeholder concerns in the region, which now needs to be combined with some of the scientific evidence and especially with institutional responses to chart future actions on adaptation to climate change (Tiessen, 2008).

The consultation process itself has provided participants with opportunities "for intellectual independence, outside the national communication processes in each country, thereby creating the basis for a useful virtual network" (Conde, 2008)[22]. This is an indication that projects to address the deficiencies of regional institutional processes can be designed around appropriate consultations (Tiessen, 2008). Natenzon (2008) has considered it agile, consistent and appropriate, having convened the right people in a short period of time to produce relevant results.

5.1 Coordination

All throughout the process, FFLA maintained a smooth and effective coordination relationship through IDRC, where Marco Rondon played the role of the main focal point, with constructive participation in consultations of Walter Ubal (Mesoamerica consultation), Federico Burone (Andean consultation), and Simon Carter (Synthesis workshop).

Coordination with sub-regional partners has been effective, although responsiveness to timelines has been slower than expected. Logistics in all consultations have been excellent. A good working atmosphere was built and sufficient attention paid to details in order to make all participants in all stages of the process feel welcome and comfortable.

The expectations of the participants who attended the Consultation Process in Latin America and the Caribbean were fulfilled. In fact, they concluded that the experience was very enriching in that they were able to witness the different perceptions of the various participants, as well as the areas in which there must be more concerted efforts to face the effects of climatic change. Similarly, the quality and diversity (multidisciplinary and multi-sectorial) of the participants, the clarity of the objectives, and the quality of the documents that were presented, facilitated the identification of knowledge and information gaps.

During the final consultation in Quito, all participants expressed their satisfaction with the process and their will to keep connected with the process of crafting the research program.

It is also worth noting that the consultation process inspired a highly successful event in Bogotá called "Climate Change: challenges and opportunities for Colombia", convened in June, 2008, by the World Bank, the Colombian Ministry of Environment, and the Dinero Magazine. The meeting gathered 130 managers and presidents of the most important companies of the energy, industry, trade, tourism, agriculture, and transportation sectors, plus the participation of ministers and vice-ministers of agriculture, mining, energy, trade, industry, and national planning. It was widely disseminated in the media and considered a success by participants.

22 *Comment during final workshop May 16th.*

5.2 Participants – main gaps

One of the main gaps in the process stems from the reluctance of the private sector to take an active part in the consultations. A reduced number of participants from the private sector attended the Andean meeting although a larger representation was expected; in the Caribbean region, project leaders participated in the Tourism Association regional meeting in Barbados; in Mesoamerica, participation in a private sector meeting on climate change allowed their views to be incorporated in this document. Individual approaches have been made and the response reveals that they are not always interested in participating in meetings where the agenda is broader than their immediate concerns; they would prefer shorter meetings with their peers.

The energy sector was not present and all meetings underlined the importance of their voices in the debate and proposals. Three other reviewers stated very clearly that the energy sector cannot be left out of the climate change research priorities, particularly in a region where hydropower is very important. While the energy sector has been somewhat reluctant to believe in climate change and has even argued that the uncertainties in climate change projections are too high, this may now be changing (Marengo, 2008). Consequently, some critical issues have not been mentioned in the consultation, such as the relationship of agriculture to the energy and carbon cycle. This is not only important in the context of mitigation. Rightly the consultations point to the relatively small contribution by the regions to global greenhouse gas emissions, and therefore give limited emphasis on mitigation. But energy use has serious feedbacks to production costs. Fossil fuel dependent farm inputs are already a major factor in food inflation. Particularly the use of N fertilizer, which is produced under an energy-intensive process, raises farming costs. The alternatives of biological N fixation will become more important as N fertilizer becomes less affordable. At the same time, little is known about the ecological limits of N fixation in the tropics. The International Nitrogen Initiative (INI) with its new host at the University of São Paulo is well placed to follow up on these concerns. (Tiessen, 2008). Also, even though water availability, integrated water management and watershed management were frequently mentioned, the critical inter-sectorial competition between agriculture, industry and power generation was not. The energy sector was not present at the consultations. The tri-national (Argentina-Brazil-Paraguay) ITAIPU project provides a basis for such discussions and is already cooperating with scientific investigations (Tiessen, 2008).

Agro-industry was highlighted as an important sector in national economies in Mesoamerica, Andean and Southern Cone Regions, yet its response to the climate change challenge is unarticulated and dependent on a limited number of individual actions.

Many participants felt it would have been useful to have representatives from Ministries of Industry, of Finances, or Energy. But, climate change impact and discussion is perceived as a topic for Environmental Ministries and Institutes and other governmental agencies do not feel yet involved or responsible.

The private sector was not well represented in the Mesoamerican consultation. Further follow up was undertaken by INCAE in several of the Mesoamerican countries in order to bring its voice. The Mesoamerican private sector believes that all society members are vulnerable to climate change, yet the most vulnerable are the rural poor who live from agriculture. The private sector is aware that it could be affected by energy scarcity in dry seasons. On the other hand, potential effects on the Panama Canal are seen as one of the main threats to the region. The private sector (tourism and agro-industry) have undertaken good but isolated environmental initiatives and renewable energy projects. But the motivation to do it, far from responding to climate change, comes from the opportunity for improving business by certifying their operations.

Finally, the importance of local authorities was also brought up in all meetings and, although they were considered a relevant stakeholder, not much effort was made to prioritize their participation.

6

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7

Acronyms

Acronyms

AUGM	Asociación de Universidades del Grupo de Montevideo
CAN	Comunidad Andina de Naciones
CARICOM	Caribbean Community
CATHALAC	Centro del Agua del Trópico Húmedo para América Latina y el Caribe
CATIE	Centro Agronómico Tropical de Investigación y Enseñanza
CBD	Convention on Biological Diversity
CDM	Clean Development Mechanism
CER	Certified Emission Reduction
CLACDS	Centro Latinoamericano para la Competitividad y el Desarrollo Sostenible of the INCAE Business School
CLACSO	Consejo Latinoamericano de Ciencias Sociales
CPACC	Caribbean Planning for Adaptation to Climate Change
DFID	Department for International Development of the United Kingdom
ECLAC	Economic Commission for Latin America and the Caribbean (ECLAC)
FAO	Food and Agriculture Organizations
FFLA	Fundación Futuro Latinoamericano
FLACSO	Facultad Latinoamericana de Ciencias Sociales
GDP	Gross Domestic Product
GECAFS	Global Environmental Change and Food Systems
GHG	Green-House Gas (GHC)
IAI	Inter-American Institute for Global Change Research (IAI)
ICT	Information and Communication Technologies
IDRC	International Development Research Center
IGP	Instituto Geofísico del Perú
INI	International Nitrogen Initiative
INPE	Instituto Nacional de Pesquisas Espaciais
INTA	Instituto Nacional de Tecnología Agropecuaria
IPCC	Intergovernmental Panel on Climate Change
IWRM	Integrated Water Resources Management
LAC	Latin America and the Caribbean
MACC	Mainstreaming Adaptation to Climate Change
MERCOSUR	Mercado Común del Sur
NGO	Non-Governmental Organization/s
OET	Organización de Estudios Tropicales
PA	Protected Areas
PRAA	Proyecto Regional Andino de Adaptación al Cambio Climático
REDD	Reducing Emissions from Deforestation and Degradation
RIDES	Recursos de Investigación para el Desarrollo Sostenible
SICA	Sistema de Integración Centroamericana
UNCCC	United Nations Conference on Climate Change
UNFCC	United Nations Framework Convention on Climate Change
UNEP	United Nations Environment Program
URACCAN	Universidad de la Costa Caribeña Nicaragüense
UWI	University of the West Indies (UWI)
VRIM	Vulnerability-Resilience Indicator Model
WRI	World Resource Institute

8

Annexes I, II, III, IV

This document is based on the synthesis of press releases developed by several Latin American participants of the Fourth Assessment Report of the IPCC, Working Group II (IPCC-WGII, 2007) and on a recent contribution (Conde et al, 2007) for the UNDP Human Development Report 2007/2008. The text is arranged as follows: Section 1 provides a brief results summary of research predictions on climate change at the global level in order to serve as an introduction to further presenting concrete facts for the Latin America and Caribbean region. Section 2 presents some recent natural hazards and discusses the main findings concerning climate change impacts from some cases studies in Latin America. It discusses economic vulnerability and some adaptation measures as well. Section 3 concludes with a set of suggestions for further research to address climate change in the region.

ANNEX I: Regional Overview Paper by Cecilia Conde

Climate Change in Latin-America and Caribbean Countries:Impacts, Vulnerability and the need for Adaptation

Prepared by:
Cecilia Conde-Álvarez and Sergio O. Saldaña-Zorrilla[23]

Working Paper
for the Regional Consulting Meeting on Priorities, Capacities and Challenges on Climate Change Research in Latin-America and Caribbean Countries

Port of Spain, Trinidad and Tobago, on January 24th and 25th, 2008

Organized by the Fundación Futuro Latinoamericano with the financial support of The International Development Research Centre (IDRC) and the Department for International Development (DFID-UK)

1. Introduction

The Fourth assessment report of the IPCC (IPCC-WGI, 2007; Pachauri and Jallow, 2007) states that "warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global mean sea level". Average air temperature has rise 0.74ºC [0.56 to 0.92] for 1906 to 2005, and ocean temperatures have increased to depths of at least 3000 m.

The conclusion: "Most of the observed increase in globally averaged temperatures since the mid-20th century is very likely (90%) due to the observed increase in anthropogenic greenhouse gas concentrations" is perhaps one of the most important findings in the IPCC Fourth Assessment report (IPCC; WGI).

This report also states that high temperatures of the last half century are unusual, compared to the previous 1300 years and observed changes in climate include changes in Arctic temperatures and ice, widespread changes in precipitation amounts, ocean salinity, wind patterns and aspects of extreme weather including droughts, heavy precipitation, heat waves and the intensity of tropical cyclones. Also, significantly increased precipitation in eastern parts of North and South America, northern Europe and northern and central Asia have been observed, as well as longer droughts observed since the 1970s, particularly in the tropics and subtropics.

Future scenarios project that for the next two decades a warming of about 0.2°C per decade is projected for a range of SRES emission scenarios, and by 2100 temperature could increase between 1.8 to 4.0ºC above the 1980 – 1999 average. Even if the concentrations of all greenhouse gases and aerosols had been kept constant at year 2000 levels, a further warming of about 0.1°C per decade would be expected. Sea level rise is projected to increase 0.18 to 0.59 m, and is very likely that heat waves and heavy precipitation events will continue to become more frequent. It is probable that future tropical cyclones will become more intense, with larger peak wind speeds and heavier precipitation. Impacts are occurring now

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as a consequence of climate change and future possible impacts have been identified (IPCC-WGII, 2007). Water supplies stored in glaciers and snow cover are projected to decline, reducing water availability in regions supplied by melt water from major mountain ranges, where more than one-sixth of the world population currently lives. From 20 to 30% of plant and animal species assessed so far are likely to be at increased risk of extinction if increases in global average temperature exceed 1.5-2.5ºC. At lower latitudes, crop productivity is projected to decrease for even small local temperature increases (1-2°C). At higher latitudes, crop productivity is projected to increase for temperature increases of 1-3°C, then decrease beyond that.

Many millions of people are projected to be flooded every year due to sea-level rise by the 2080s. The most vulnerable industries, settlements and societies are generally those in coastal and river flood plains, especially those whose economies are closely linked with climate sensitive resources, e.g. agriculture, and those in areas prone to extreme weather events, especially where rapid urbanization is occurring. Projected climate change-related exposures are likely to affect the health status of millions of people, particularly those with low adaptive capacity.

2. Climate change in Latin America

In Latin America, during the last decades, important changes in precipitation and increases in temperature have been observed, and land-use changes have intensified the use of natural resources and exacerbated many of the processes of land degradation (Magrin et al, 2007). The expected increases in sea-level rise (SLR), weather and climatic variability and extremes are very likely to affect coastal areas (high confidence). The projected mean war'ming for Latin America to the end of the century, according to different climate models, ranges from 1 to 4°C for the SRES emissions scenario B2 and from 2 to 6°C for scenario A2 (medium confidence). By the 2020s, the net increase in the number of people experiencing water stress due to climate change is likely to be between 7 and 77 million (medium confidence). By mid-century climate change is projected to lead to the gradual replacement of tropical forest by savanna in eastern Amazonia. It is projected that semi arid vegetation might be replaced by arid-land vegetation (IPCC-WGII, 2007). Further projections for Latin America consist of (Magrin et al, 2007):

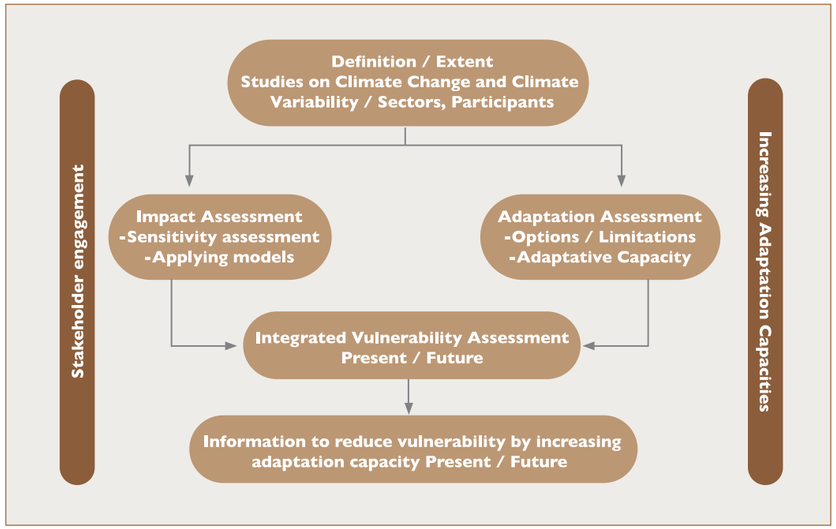
- In drier areas (i.e. central and northern Chile, coastal zones in Peru, northwestern regions in Brazil, west and northwest of Argentina, and large areas of Mesoamerica) climate change is expected to lead to salinization and desertification of agricultural land;
- Sea-level rise is projected to cause increased risk of flooding in low-lying areas. Increases in sea surface temperature due to climate change are projected to have adverse effects on Mesoamerican coral reefs, and cause shifts in the location of southeast Pacific fish stocks;
- Under future climate change, there is a risk of significant species extinctions in many areas of tropical Latin America (high confidence);
- Future sustainable development plans should include adaptation strategies to enhance the integration of climate change into development policies (high confidence).

Research challenges for LAC

The IPCC-WGII (2007) Latin America chapter points out the following major concerns in the region and needs for future research on climate change: (I) weakness of the climate change projects and policies, especially when communicating risk to stakeholders; (II) inter and multi disciplinary research is seldom performed; (III) "constraints already identified in terms of facing current climate variability and trends, such as: lack of awareness; (IV) lack of well-distributed and reliable observation systems; (V) lack of adequate monitoring systems; (VI) poor technical capabilities; (VII) lack of investment and credits for the development of infrastructure in rural areas; (VIII) scarce integrated assessments, mainly between sectors; (IX) limited studies on the economic impacts of current and future climate variability and change; (X) restricted studies on the impacts of climate change on societies; (XI) lack of clear prioritisation in the treatment of topics for the region as a whole. In addition, other priorities considering climate change are: to reduce uncertainties in future projections of climate change paths and to assess the impacts of different policy options on reducing vulnerability and/or increasing adaptive capacity."

In this context, a new generation of impact, vulnerability and adaptation studies is being developed at the global level (see figure 1).

Figure 1. *Description of the method followed by new climate change studies (Lim, et al, 2005)*



These new studies require climate change scenarios and models that can allow impact assessments on biophysic systems (i.e., vegetation, flows, crops). But, additionally, other approaches are needed:

1. Interdisciplinary research teams, which engage key stakeholders (decision makers, affected groups or sectors) of the region or sectors under study in the definition of the scope of the research project.
2. Engage key stakeholders in every step allowing them to determine the evolution of the research process to the point where they can assess and apply tools that will increase their present and future adaptive capacity.
3. Insert climate variability studies, i.e. the climate history of a region or area, including climate variations regarding normal conditions. Son de particular interés en estos estudios los eventos climáticos extremos (sequías, lluvias torrenciales, ondas de calor, heladas, vientos fuertes, por ejemplo).
4. Assess present and future vulnerability and adaptation capacity according to present and projected climate conditions.
5. Analyze the potential of increasing adaptive capacity, based on present and future vulnerability. By doing this, adaptation decisions will not be a final output of a climate change impact assessment but rather a result of documenting present strategies and assessing their future feasibility since the beginning and all through the research process.
6. Consider the possibility of mainstreaming these adaptation strategies into sector-specific policies and programs on biodiversity, desertification and poverty reduction, in order to optimize and align dispersed efforts.

To address partially those issues, Conde et al (2007) reviewed some of the efforts performed by several vulnerability and adaptation research projects. Several studies performed by the Economic Commission for Latin America and the Caribbean[24] shows that floods, landslides, hurricanes and droughts are the major hydro-meteorological threats in the region. Even though the number of human deaths caused by those events has decreased over the past two decades, the number of affected populations increased dramatically (ECLAC, 2003). Other studies (Zapata, 2006) show that the cost of those disasters was around 250 billion USD for the period 1972 to 2005, and are estimated to be near 50 USD billion from 2000 to 2010. These figures show that it is urgent to "adopt, as part of the development policies and to achieve the millennium goals, those measures that mitigate the vulnerability to increasing and multiple threats" (Zapata, 2006).

24 *Turn to:* http://www.eclac.cl

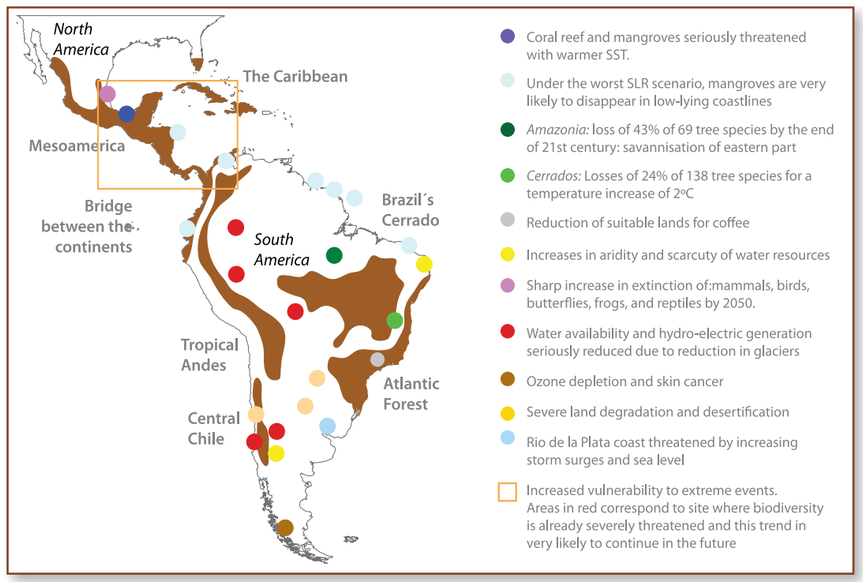
Figure 2. *Areal extent of Chacaltaya Glacier, Bolivia, from 1940 to 2005*

Source: IPCC-WGII 2007

Living conditions and livelihoods opportunities for millions of people will be in danger in Latin America (Stern 2006). Some scenarios under climate change conditions project that maize production by 2055 will drop by around 15% on average (Stern, 2006). This possibility will endanger the subsistence and food security of the majority of the rural population in the region. In addition, the landscape has been dramatically changing within a relatively brief time period (see Figure 2 above), threatening survival of ecosystems, species, and, thus, stressing human livelihoods.

In climate change conditions, agricultural activities are highly probable to suffer significant yield decreases in most Latin American and Caribbean countries (LAC), pests will probably expand their territory and soil degradation processes will continue to increase. Droughts, floods, heat waves, frosts, hail and other climate extreme events have significantly affected agricultural activities in human history. The limited capacity to forecast those events, to communicate "useful" forecasts, but also to cope with them, determines not only the agricultural output, but, most important, the farmers' livelihoods and, in developing countries, even puts at risk their food security.

Figure 3. *Key hot spots from climate change in Lafin American and the Caribbean*



Source: IPCC-WGII 2007

2.1 Past and present impacts

In Latin America, El Niño/Southern Oscillation (ENSO) is the most important source of climate variability and has caused the largest economic and social impacts. Hurricanes are increasing in both frequency and severity in the North of the LAC region, concretely affecting the Caribbean Basin, Mexico and Central America.

2.1.1 Niños

Strong ENSO events have modified climate conditions and impacted severely, particularly on rain dependant agriculture. In the case of Mexico, changes in rainfall patterns are observed during the strong El Niño events (1982-1983, 1997-1998) as well as during the strong 1988 – 1989 La Niña event. In almost all the Mexican territory, severe summer droughts have affected the agricultural activities during strong El Niño events, leading, for example, to the economic loss of ca. 1.5 billion USD during the 1997-1998 event (Magaña et al, 1999, Conde et al, 1999). In Argentina, El Niño events are associated with enhanced likelihood of higher than the median precipitation anomalies during October-February in the main agricultural areas, while lower than the normal precipitation during the same period was typical of cold ENSO events (Messina, et al. 1999; Ropelewski and Halpert, 1989).

In some case studies in Argentina, farmers identified floods, droughts, and hailstorms as the most important events affecting their activities, of which floods caused comparatively more damages (Riverola et al, 2002; Seiler et al, 2002; Seiler and Vinocur, 2004). For example, five of the ten wettest years since 1980 occurred during El Niño years in Cordoba, and also severe droughts were recorded in 1988-1989 (La Niña year) and important losses in maize yields occurred during 1986-1987 (El Niño year).

During the last 25 years, three major flood episodes have occurred in a study region in Cordoba, Argentina. It has brought clear production drops as well as socioeconomic damages lasting for years in the affected areas. The flooding area corresponds to the poorly drained plains in the south of the region. In addition to natural climate variability, in the south of Cordoba it is perceived that there is increased variability possibly as a consequence of climate change (see Box 1). Fluctuation of the climate during the seasons, the occurrence of anomalous temperatures and precipitation, as well as soil moisture availability, exert in the region the greatest influence upon both intra and inter annual onset of the crop season and in the consequent crop growth, development and yield (Gay et al, 2006).

Box 1. *Measuring a vulnerability index for Argentina (Final AIACC report)*

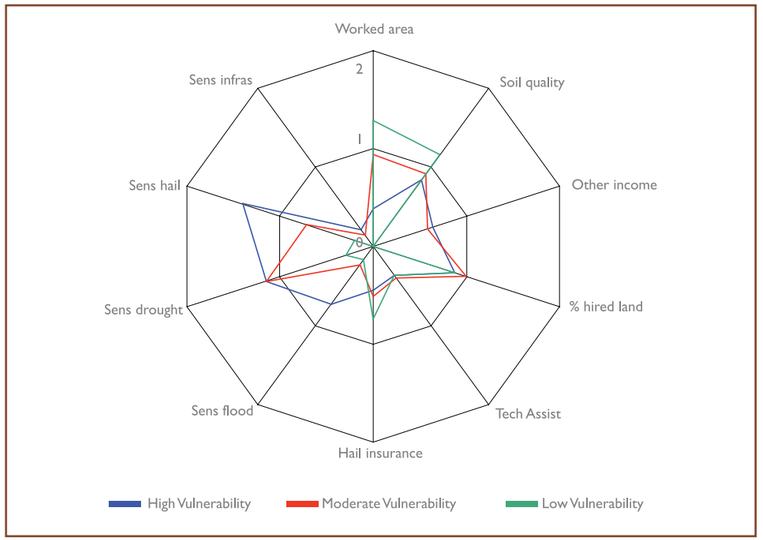
The whole Cordoba province is about 16.532.100 hectares, 83% of it devoted to agricultural activities. This province is in the center of Argentina and ranks fifth in size among all the Argentine provinces. Cordoba contributes about 14% of the national agricultural GDP (Gross Domestic Product), 14% of the national livestock, 17% of the cereal and 25% of the national oilseed production. The agro-food and agro-industrial systems are the most dynamic and important in the economy, representing 25% of the state GGP (Gross Geographical Product) (INTA, 2002). This province is the second largest maize producer in the country contributing about 32% of the total national production (SAGPYA, 2004).

The South of the Cordoba region comprehends 6 of the 13 different agro ecologic zones (AEZ) of the Province. The main agriculture systems are cash crops and livestock. Focus groups, interviews and a survey (similar to the one applied in Mexico) were implemented to construct indicators related to resources (human, financial, social), management capacity/diversity, previous risk mitigation actions, climate information and impacts, economic strategies, public institutions and decision making. Four localities were selected to implement the survey, namely Laboulaye, Río Cuarto, Marcos Juárez and Oncativo. Climate Sensitivity and adaptive capacity indicators were obtained for 16 farmers groups and each of the indicators represents one or more variable from the survey data. These indicators aimed to identify producers' sensitivity to different adverse climate events and the main resources available for farmers to respond to stress and uncertainty. The overall vulnerability of each farm group was assessed qualitatively by comparing the aggregate scores for the sensitivity and adaptive capacity indices.

Only two farmers' groups can be distinguished within the low vulnerability class, representing only 13% of the surveyed farmers. Both groups are in Marcos Juárez area, where climatic risks are lower, belonging to the humid pampas, less exposed to hail storms and few flooding problems. This class is comprised of the groups with the lowest sensitivity indices.

The high vulnerability class is represented by five of the sixteen defined groups and represents 43% of surveyed farmers, exposed to floods (those in Marcos Juárez and Laboulaye areas), hold the highest sensitivity to hail storms (Río Cuarto and Oncativo areas), or highly exposed to drought (Oncativo area). The moderate vulnerability class, representing half of the surveyed population, shows different combinations of agricultural systems, sensitivity (due to different climatic exposure) and adaptive capacity (landholding size, soil quality, management of the farm) that reflect climate variability incidence on farmers' livelihoods in the studied region. The diagram in figure 4 show the synthesis of the vulnerability classes and the weighted indicators described above.

Figure 4. *Synthesis of the vulnerability classes and the weighted indicators*



Source: (AIACC final report, Wehbe et al, 2005)

2.1.2 Hurricane exposure in the Caribbean region

The very strong, extreme climatic events that increasingly hit the Caribbean Basin warns us of potential forthcoming damages as long as no action to reduce climate change impacts is taken both at global and, most important, domestic level. Such events have exposed the different degrees of coping capacity of countries and states in the LAC region, exemplifying how vulnerability varies greatly in accordance with the level of their development. In the Caribbean Basin, countries and states are increasingly affected by Atlantic tropical systems ranging from tropical storms and depressions to category five Hurricanes (Saffir-Simpson scale). However, the link between development and risk and disaster management varies widely among this region, embracing those appropriate disaster response and management (as in Cuba), minor global impact on the national GDP but with relevant local economic consequences, e.g. Florida and Yucatan, significant impact on the whole economy of a small island development state, e.g. Grenada, Cayman Islands, and spillovers of losses to the total economy, e.g. Jamaica and Dominican Republic (ECLAC 2004a). Economic losses from hurricanes have been significant in the Caribbean, frequently exceeding 100% of the GDP value when a hurricane hits, as in the case of Grenada (212%) and the Cayman Islands (138%) during the 2004 hurricane season (ECLAC 2004c). Growth paths tend to decline following hurricanes in this region, as the case of the Bahamas, whose 2003 GDP growth prospects from the World Bank before hurricanes Frances and Jeanne were estimated at 3.0%, but after these events it dropped to 1.3% (ECLAC 2004b).

2.2 Vulnerability: economic development and poverty

One has to admit the need for joining LAC to global efforts and actions towards mitigating climate change. However, this region contributes only ca. 3.5% of global greenhouse gas emissions (GHG), and few other drivers of climate change (IPCC 2007). Even though it is relevant for achieving sustainable economic growth to prevent potential future increases in GHG emissions from this region, the mere fulfilling of current mitigation commitments in LAC will not necessarily prevent this region from suffering negative impacts from climate change. It suggests, then, the need for setting vulnerability at the top of the list of priorities in the research and policy agenda concerning climate change in this region. Despite the dramatic losses from natural disasters and the forecasted negative impacts from climate change in the LAC region, there are still enormous research blanks on/in LAC concerning vulnerability analysis. Although vulnerability has a unique meaning for different research communities (Downing and Downing and Pathwardhan, 2005; O'Brian et al, 2004), the IPCC Fourth Assessment Report (IPCC, WGII, 2007) defines vulnerability as "the degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate change and variation to which a system is exposed, its sensitivity, and its adaptive capacity". Analyzing vulnerability demands (i) to identify affected agents, e.g. societies, economic sectors, livelihoods, ecosystems, etc; (ii) the concrete hazard, e.g. extreme weather events, and; (iii) the way agents and hazards interact. In analyzing that interaction, social and economic conditions play a crucial role.

2.2.1 Economic vulnerability to climate change

In the economics literature, vulnerability is considered as a situation in which least developed countries (LDC) find themselves in a dominance and dependence relationship vis-à-vis the developed countries, Todaro (1982). In this view concretely, LDC are said to be economically vulnerable to the decisions of rich nations in areas such as trade, private foreign investments, foreign aid, technological research, development, etc. This is a useful concept whose asymmetry component is closely interconnected with other concepts from the economics of development, like the center-periphery relations and terms of trade in the works of Raúl Prebisch (1950, 1973). In line with Todaro's definition, the United Nations Conference on Trade and Development (UNCTAD) defines economic vulnerability as the structurally more exposed position of LDCs than most other developing countries to external economic shocks. Also, UNCTAD points out that economic vulnerability implies consequences of major global and regional economic and financial disturbances and increases in the prices of critical imports such as energy products. The typical export dominance of a single commodity or service sector makes their economies particularly vulnerable to adverse physical or economic shocks (UNCTAD 2001), especially in the case of mono-crop economies.

Box 2. *Productive re-orientation, a structural adaptation measure*

The practically mono-crop economy in a surveyed region of Chiapas (Saldaña 2005), provides evidence of the amplifying negative impacts from climate adversity and sudden trade changes. The main agricultural products of the interviewees are white maize (46%) and coffee (41%). It increases their vulnerability given the decreasing prices of white maize and coffee experienced over the last 20 years. The neo-classical approach of economic theory considers mono-crops as positive in that of exploiting local comparative advantages, producing scale economies, as well as due to the benefits derived from high specialization in the sense of the work division of Adam Smith. Nevertheless, these advantages are counteracted when the respective commodity markets turn highly volatile or prices drop dramatically, as in this case.

Low rural incomes in this region are considered a result of a complex economic-climatic process, whose solution should embrace not only social programs, rural-urban emigration, and post-disaster aid, but also issues of inequity, productive reorientation and implementation of disaster prevention instruments. Productive reorientation seems to be a feasible economic response to adapt to negative terms of trade of and within the agricultural sector. The low dynamism of the industrial sector of the past two decades in Mexico has impeded the urban economy from absorbing most of the additional workforce released from the agricultural sector. For that reason, productive re-orientation should still be projected within the agricultural sector itself. Otherwise, the current increasing trend of slums proliferation in large cities as well as illegal emigration to, mainly, the USA, will become harder to manage. It implies finding means of both diversifying crops to reduce the probability of being affected by sudden price drops in the mono-crop, as well as moving to more rentable crops, that is, whose market prices are relatively higher, with a more stable demand and more suitable to regional environmental and climatic conditions. In a study in the state of Veracruz, Mexico, Gay et al (2004) analyzed the high vulnerability to extreme climatic conditions in a coffee producing region, which is being increasingly affected, and warns about the low viability of growing coffee there (once some of negative effects of policy changes and market instability are internalized).

From the Chiapas study, 58% of interviewed farmers have plans to diversify to higher profitability crops given current trends of decreasing prices of traditional agricultural products. Over 87% of the farmers have maize and coffee, whose prices have been decreasing over the past ten years. In counterpart, cropping fruits and vegetables represent higher profitability to farmers in this region given favorable climatic conditions and relative prices. Based on a World Bank report, fruits and vegetables are considered to have higher comparative and competitive advantages to the Mexican agricultural sector, especially to export to North-America in the framework of the North America Free Trade Agreement (NAFTA) (Lederman et al 2003). Even despite higher freight and insurance costs in the South to export to the USA and Canada, the relatively greater water availability in the South may make the said crops highly rentable –of course, once the water management infrastructure has been constructed. Under such circumstances, there is widespread demand –from interviewees and stakeholders- to promote more actively the current governmental productive re-orientation process, as well as to operate in a more participatory manner in order to achieve realistic and sustainable results.

In the stakeholders' views, there is also a widespread feeling concerning the absence of an effective and long-term sustainable strategy to strengthen the adaptive capacity of subsistence farmers in this region to external shocks, which is an obstacle for accumulating assets. The prevailing conditions of marginalization and low education levels in this region may explain the passive attitude of the self affected population to come up with initiatives to reduce vulnerability. It demands a more active promotion from the public. The insufficient government investments in infrastructure, limited credit granting, insufficient subsidies to crop insurance, and lack of investments in more rentable crops, greatly reduces the communities' coping capacity when hazards strike, which in turn is leading to soaring emigration and social instability levels in the region.

So, in the early 1990s, UNCTAD developed a first attempt to construct an index of economic vulnerability[25], and in 1994 the Programme of Action for the Sustainable Development of Small Islands Developing States (SIDS) adopted an index of economic vulnerability, expected to demonstrate that SIDS were generally more vulnerable to global change than other developing countries. The UNCTAD Economic Vulnerability Index was constructed as a composite indicator based on three fundamental dimensions: (1) the magnitude of external shocks beyond domestic control (measured through indicators of the instability of agricultural production and exports); (2) the exposure of the economy to these shocks (estimated through the share of manufacturing and modern services in the gross domestic product, and an indicator of merchandise export concentration), and; (3) the structural handicaps explaining the high exposure of the economy (taking into account economy's smallness, measured by a proxy demographic variable) -UNCTAD 2003.

In the view of Briguglio (2002), a country can be economically vulnerable and yet re-gister a relatively high GDP per capita. Countries like the SIDS are particularly economically vulnerable due to their limited ability to exploit economies of scale, lack of natural resour-ces, low diversified economy, dependence on narrow range of exports, and high dependence on imports of strategic goods, i.e. fuel and food. Notwithstanding, what essentially makes a country economically vulnerable in the definition of Briguglio, is its exposure to economic forces outside its control. Thus, the peripherality condition of an economy goes beyond geographic insularity and remoteness (leading to high costs and margina-lization from world trade), but also includes inability to influence international prices (price-taker economies).

However, being vulnerable is not only a question of poverty and smallness of a country, as this work indicates. Vulnerability applies also to countries of large populations and large economies, whose vulnerabilities are less visible at a glance, and only through more detailed analysis exhibit differential vulnerabilities due to dualistic characteristics (Rodriguez 1980). Latin American countries like Mexico, Brazil, and Argentina should not be considered as entirely vulnerable, but unequally vulnerable, whose rich and poor societies, high productive and left-behind economic sectors, etc. coexist at differential degrees of vulnerability (Rodriguez 1980, Colosio 1979). In sum, economic vulnerability is the susceptibility of an economic agent to absorb external shocks, e.g. natural hazards, negatively, given its coping capacity, e.g. assets possession and entitlements system, as well as its implemented adaptive measures, e.g. risk management and protection measures (Saldaña 2006a). Coping capacity can be defined as the ability of a unit to respond to a harmful occurrence as well as to avoid its potential effects, whereas adaptive capacity is the ability of a unit to gradually transform its structure, functioning or organization to survive under hazards threatening its existence (Kelly and Adger 2000).

2.2.2 Climate change and assets accumulation

Increasingly, scholars argue that poverty is not only a lack of income or consumption, but also a lack of assets (Haveman and Wolff 2000, Oliver and Shapiro 1990, Sherraden 1991). Asset poor households are those with insufficient resources to invest in their future or to sustain household members at a basic level during an economic disruption (Fisher and Weber 2004). Among other authors, Chambers (1989) writes about the relevance of increasing assets in low-income families, since this improves human conditions beyond poverty just in terms of flow, but also structural vulnerability. He affirms that vulnerability is even more interlinked with net assets than poverty. For authors like Vatsa & Krimgold (2000), vulnerability is a broader and more dynamic concept, which involves the poor, but also households living above poverty line at risk of falling below in case of an income shock, that is, the "new poor". Given that linkage, factors that obstruct an accumulation of assets are, in turn, impeding poverty reduction and putting additional populations into poverty. For instance, losses from increasing natural disasters or income reductions due to depressed agricultural prices impede rural households in accumulating assets, creating a vicious cycle of inefficient risk management strategy, low return, low consumption, low savings and investment (Saldaña 2006a).

2.2.3 Relative vulnerability of the poor

One of the main issues increasing vulnerability to extreme climate events in Latin America is the acute poverty. By 2005 (CEPAL 2006), 28.9% of its population (209 million people) lived in poverty conditions, and 15.4% (81 million) were extremely poor. Though being poor does not necessarily imply being vulnerable, but poverty makes individuals relatively more vulnerable to a given hazard. People living in adverse economic conditions are less able to invest in all items, including those to manage risk and increase disaster protection. Developing countries have historically been more severely damaged compared to developed countries (Benson and Clay 2000). On the one hand, total economic losses tend to be higher in rich countries in absolute terms, but compared to economy value, losses are much higher in developing countries (Saldaña 2006a). A given natural hazard with identical intensity can hit in different degrees in two distinct countries. Differences in civil protection system, health facilities and public financial ability (i.e. for reconstruction) make countries absorb hazards differently. As Cannon (1994) points out, what turns a natural hazard into a disaster is not simply a question of money, but also of economic and political systems. The way countries structure societies determines that a similar hazard leads to very different impacts among societies.

2.2.4 Coping capacity of the poor

Given current entitlements, the poor are the most prone to be negatively impacted by natural disasters, especially in developing countries. The distribution of human assets in many developing countries reveals high inequity. The most productive and safe terrains belong to middle- and upper classes, whereas less productive and/or unsafe areas were left to the poor. Most of the victims of Guatemala's earthquake in 1976 were poor (23,000 deaths), who lived in ravines and gorges, areas very prone to disaster in case of earthquakes or landslides. The river Oder, which divides Germany from Poland, overflowed in 1997 producing severe floods. Lack of maintenance of dykes and flood defenses, together with poor people living along the river on the Polish side, produced notoriously higher damages there than on the German side (Vatsa & Krimgold 2000). That reveals, on the one hand, budgetary differences to mitigate disasters between these countries. On the other hand, it reflects differences in living conditions within population in these countries, as in both countries assets of lower income people were more affected. Similar evidence was found in Honduras with Hurricane Mitch (Vatsa & Krimgold 2000), El Salvador Earthquake in 2001 (ECLAC 2001), Dominican Republic with Hurricane George (Butterfield 1998), the United States of America when hurricane Katrina hit in 2005 (O'Brien 2005), among others.

25 *Cfr. Briguglio, L. (1992). Preliminary study on the construction of an Index for ranking countries according to their economic vulnerability. Report to UNCTAD, 1992.*

Box 3. *Crop insurance coverage: lessons to learn inside Latin-America*

As an adaptation measure, risk-sharing in the form of crop insurance in Latin-America presents a number of challenges. Low coverage and insufficient use tend to be common, but causes vary widely among countries. Whereas Uruguay experiences high coverage even without governmental subsidy, insured cropland in Chile is increasing thanks to discriminatory subsidies combined with the participation of private insurers. In contrast, Mexico continues to maintain low coverage even despite governmental subsidies and the facilities conceded to private insurers. Argentina presents both low coverage as well as the absence of governmental subsidy.

Uruguay. So far, the Uruguayan government does not provide any subsidy to crop insurance. However, insurance coverage in this country is greater than in most subsidized agricultural schemes in the world. Since the 1970s, self-insurance (autoseguro agricola) has been an intensively employed instrument. It consists of a shared-risk pool funded by farmers This instrument mainly covers hail risk of winter crops. Unlike the rest of Latin-American countries, the increasing number of natural disasters experienced in the 1980s in Uruguay led to the emergence of a number of private crop insurance companies, taking over from the state monopoly in this market.

Chile. Chilean agriculture is recurrently hit by frosts –due to the dominating Andes-, droughts in the North –besides the Atacama desert- and heavy rains throughout most of the territory. In 2000, the Ministry of Agriculture established the agricultural insurance company (COMSA), which is operated by private insurance companies. COMSA grants subsidies depending on farmer production scale. Crop insurance in this country embraces climate and market risks. The subsidy consists of financing 50% of net premiums on average, plus a fixed fee (ca. US$ 36) per insurance contract. The subsidy grants small-scale producers with 80% of the premium price; 50% for medium farmers; and less than 50% for large scale farmers. The subsidy covers up to US$1,320 per farmer/season, and embraces most crops types. Since 2001, net weighted surface coverage of the subsidy exceeds 50% of cropland, high compared to Mexico (10%) and Argentina (7.7%). Besides risk management, resources allocation matter: per-farmer subsidy in Chile is around four-fold higher than in Mexico.

Argentina. Only 2 of 26 million hectares of cropland are covered by insurance in Argentina. Mainly due to budgetary constraints, the government is reluctant to subsidize. It exacerbated after the 2002 economic crisis. 70% of existing insurance contracts cover exclusively hail, 29% are multi-peril, and 1% covers livestock. Despite the fast growth of the crop insurance market during the present decade (annual 12%), insurance coverage is still expensive for producers: premiums cost fluctuates between 3 and 6% of production costs. During this period, increasing pressure from social and economic actors demand that the government implements crop insurance subsidy in light of the increasing risk associated with the adoption of enhanced technologies along with the climatic variability. The exports boom of agricultural goods (mainly soy bean) and livestock to China over the past five years has generated unexpected revenues to the country, which is being used as the main argument to give agriculture some subsidies in return.

Source: Saldaña 2006 a

3. Research challenges and further directions

The lack of integrated assessments of climate change seems to be a crucial constraint in the LAC region. Prevailing insufficient observation and monitoring systems has led to poor technical capabilities to generate reliable information for research and policy. Only few isolated studies on the impacts of climate change on societies have so far been conducted in this region. Concerning economic sectors, there is a need for projecting investments and credits for the development of infrastructure, especially for the rural economy because of its comparatively higher exposure to climate change. In sum, limited studies on the economic impacts of current and future climate variability and change are leading to the lack of clear prioritization of topics for the region as a whole.

Although –mainly due to the lack of research and study cases- the present document does not address the whole LAC region, it provides useful highlights for a number of countries sharing similar environmental and human conditions. As observed in some surveyed regions, illustrated in Boxes 2 and 3, the adaptation to climate change of subsistence farmers is being constrained by current trends in institutional change and agricultural policy. In addition, insufficient capacity building will lead to dramatic results if extreme climate events continue to increase in frequency and/or severity. It demands a more active role of the government to fulfill that gap. Public policy has still to face the challenge of integrating better climate change and variability research into practices and policies. In the case studies of Mexico and Argentina, key stakeholders came up with concrete adaptive measures, e.g. greenhouses, irrigation, credit, among others. However, technical instruments like these cannot last long if coping capacity does not embrace a continuous learning process to program adaptation options based on climate and markets predictions. Currently, the risk management and disaster prevention measures in most LAC countries should overcome institutional and technological barriers for their optimal operation. Future research must center efforts in analyzing barriers and opportunities these measures represent, particularly if new technologies and policies are be needed, given the forthcoming global change conditions.

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ANNEX III: Consultant's Report of the National Environmental Conference held in Brazil, on May 7th- 11th, 2008

Third National Environment Conference - Climate Change

Prepared by:
Joana Vilar and Carla Gualdani

"We can not go back, not a centimeter, from here only forward"
Minister Marina Silva, during the plenary of the III NEC

Introduction

The Third National Environment Conference (NEC) that met in Brasilia, May 7 to 11, 2008, had Climate Change as its central theme. The meeting had the participation of over 1.200 delegates from all regions of the country that discussed and prepared proposals with the intention of contributing towards the objective of the conference: to design a policy and a national plan to address climate change

The III NEC represents one of the final phases of a process, the result of 566 other municipal conferences and 153 regional and state conferences that have brought together over 100.000 people, from which the basic text for the national conference was prepared. This text was based on more than five thousand proposals, directly and indirectly linked with the issue of climate change.

Background

During a period of five years, the Ministry for the Environment led three National Conferences on the Environment, with an ample participation of civil society and the public and private sectors. Under the theme "Let's care for Brazil", each meeting undertook the analysis of a specific issue and was able to achieve significant progress in an effort to expand the debate on matters pertaining to the environment, as well as the institutionalization of the environmental agenda of Brazil. During 2003, the I NEC had as its theme the strengthening of the National Environmental System (SISNAMA) and had the participation of 65 thousand people. The result of this process was the approval of 659 resolutions, 323 of which represented deliberations regarding the competence of the NMA and 336 recommendations dealing with the competence of other organizations

Two years later, the II NEC was held under the theme "Integrated Environmental Policies and the Sustainable Use of Natural Resources". This Conference was able to definitely consolidate a space for dialogue dedicated to environment issues. Among the main actions that followed the Conference are the consolidation of the SNUCs (National System for Conservation Units), strengthening of actions leading to the regeneration of the San Francisco River, the approval of the National Policy for Solid Waste, the construction of the National Plan for Water Resources, in addition to the inclusion of the National Council for the Environment (NCE) as a deliberative and permanent instance of the SISNAMA.

During this period, the social mobilization process also included children and adolescents, once the Conference was able to have available a version dedicated to this public. At present, during its Third edition, the National Conference of Children-Youth for the Environment has been able to promote the participation of different grade-schools and high-schools throughout Brazil.

III NEC

The III National Environmental Conference was structured in accordance with the format provided by the Group of Intergovernmental Experts on the Environment relative to Climate Change -IPCC, in which every thematic axis is divided by sectors as a basis for discussions and has a text that includes basic information on each theme, as the foundation for discussion and preparation of the proposals submitted. Participating delegations made up by representatives of social movements (Indians, traditional settlements, fishermen), non-governmental organizations (NGOs) and confederations and associations that belong to public and private sectors, attended.

Discussions dealt with themes - mitigation, adaptation, research and technological development and education and environmental citizenship - which in turn were divided into sub-themes or working groups, that included the following areas: energy, waste, constructions, forests, agriculture and livestock, industry and transport, relative to the approach to mitigate the effects of climate change; water resources, coastal and marine zones, health and human settlements, centered upon adaptation and the consequences that such changes may present.

Notwithstanding certain specificities, the ample range of subjects examined had common characteristics that provided a particular identity to this conference.

Some of the topics addressed by the Conference were: the adoption of economic instruments and communications tools to provide incentives to productive sectors to adopt less contaminating practices; enhancement of sustainable consumption, assuming responsibility for the production of waste residues and their reutilization; increase in energy efficiency; strengthening of regulating, managing and control institutions of environmental policy in different administrative. Special attention was given to the area of oversight and the adoption of mechanisms for the payment of environmental services, with emphasis on the inclusion of farming families and traditional communities.

In parallel with preparatory meetings for the working groups, a series of round table discussions were held. These deliberated on aspects of participatory democracy and the effects and positions that should be adopted relative to climate change. The round table that discussed the issue of Climate Change had the participation of Thelma Krug, Secretary of Climate Change and Environmental Quality; Joel Kovel, professor of Social Studies at Bard College; Marina Grossi, representative of the Business Council for Sustainable Development; Luciano Zica, Secretary of Water Resources of the Ministry for the Environment (MMA) and Marcos Freitas, in representation of COPPE/UFRJ.

On this occasion, Kovel stressed that the Kyoto Protocol must not be considered as a means of changing the world, but rather as an instrument that may perpetuate, in a perverse manner, the accumulation of wealth – "these are licenses to pollute and that is not the path we must take, these are steps in the wrong direction". Later he went on to say that we must change the present focus on capital, and live in a society that does not depend on continued growth, but that regulates the carbon market and strives to find ways out of carbon economy. Kovel recalled that the Kyoto Protocol will be reviewed in 2010 and that the population must be involved in the preparation of new parameters. "Social movements must become articulated against the expansion of capital. The word that governs the moment should be eco-socialism of climate change".

In this sense, Thelma Krug pointed out the villain of climate change is represented by fossil fuels. "After the Protocol, a decrease of the Greenhouse Effect Gas (GEE) emissions by developed nations was very modest, there were more compensatory measures such as 'pollute and plant', and in the meantime that is not the road". According to the Secretary, the bottleneck of Brazil is represented by its forests, in function of the clearing and burning of trees. She recalled that the 1992 Convention established a clear distinction between developed and developing nations, so that the former would assist the latter with the transfer of technology and capital, and concluded by saying that the right to growth of developing nations is legitimate, but that it must be planned to avoid committing the same mistakes of others.

The climate change regime is one of the most complex international regimes, since it implies very deep interrelations between the global economy and the environment. In order to better understand the Brazilian participation in the negotiations of a climate change regime, it is necessary to remember that it does not refer only to carbon emissions, where the nation has great advantages and one large disadvantage. The advantages are being a country of middle income (and it is outside of obligatory commitments for the reduction of carbon emissions that correspond to developed nations), having an energy matrix that has a considerable weight of hydroelectricity (over 90% of electricity is hydro-source generated) and possesses in its territory 16% of the world's forests (which have great importance in the global carbon cycle). The great disadvantage is, as the Secretary pointed out, that the use of burning practices of traditional agriculture and clearing of the Amazon forest is an important source of GHG emissions.

The performance of Brazil as a negotiator in Kyoto (1996-2001) was guided by national interest on two crucial points. The first of these was to affirm its right to development as a fundamental component of the world order, associated, of course, with environmental sustainability. The second was to prevent that the use of its forests come under international regulation and thus avoid risks to the territorial sovereignty of the nation.

In 1997, Brazil made a proposal for the creation of a Clean Development Fund (CDF) that would be constituted by the fines paid by developed countries that were unable to meet their goals for the reduction of carbon emissions. Later, in October of 1997, the United States and Brazil articulated an altered version of the CDF that was called the Clean Development Mechanism (CDM). The MCD opened the possibility for developed countries to meet a part of their emission reduction quotas by means of financing sustainable development projects in emerging and poor nations, provided that the principles of additionality and voluntary participation.

Proposals submitted on each issue are indicative of needs, starting points for a deeper discussion within society, as well as for the determination of public policies. In this manner, we next present the main proposals, observed both in the Working Groups as well as in the Final Plenary.

Forests

The Working Group on the issue of Forests was one of the most attended of the Conference. Delegates concentrated their proposals regarding the containment of the illegal deforestation in all Brazilian biomass, particularly in the Amazon Region and in sustainable production of timber and non-timber products. Proposals included subjects such as: the fight against forest fires; strengthening of oversight mechanisms through cooperation between the Armed Forces and Forest Police; providing incentives for sustainable forest management within Conservation Units (CUs); exploring reforestation with native species; implementing an ecologic-economic zoning (EEZ); and, acknowledgement of the

following biomass: Cerrado, Caatinga and Pampa and National Heritage.

Buildings

Under this theme, all proposals stressed the need to adopt technologies that would lead to rationalization in the use of materials, energy and water. Bio-climate and bio-construction should be adopted as essential paradigms. Within these proposals, the need for targeted incentives was repeatedly stressed: a) incentives for the use of technologies that reuse water in urban and rural zones; b) an incentive to improve electric energy economy by means of tax incentives; and c) an incentive for the use of electro-domestic goods that are more efficient and, the use of renewable energy in public buildings and illumination.

Transportation

Proposals regarding transportation emphasized the following needs: an increase in the energy-efficient vehicles; the construction of railroads and waterways; the use of bio-fuels; master plans for urban mobilization that give priority to the construction of bi-cycle paths and that ensure rapid access of city inhabitants to urban centers. Within these proposals, two delegates caught the public attention by proposing: the construction of a high speed train between Río de Janeiro and Sao Paulo; building parking spaces at all mass transportation stations (metro, railroads); and stopping all road construction projects in the Amazon Region, whilst new alternatives are thought of for better transportation with a lower impact.

Water Resources

On the issue of Water Resources, proposals debated were basically related to: a) better monitoring of hydro-meteorological activities; b) strengthening of the National System for the Management of Water Resources (SINGREH); and c) creating incentives for the rational use or re-use of water in urban and rural areas, through the development and application of new technologies or by means of tax incentives.

The most innovative proposals were the implementation of a National System of Forecasting and Warning for Critical Hydro-meteorological Events; the adoption of hydrographic basins as an obligatory territorial unit; the cancellation of works for the transposition of the San Francisco River; and the reaffirmation of the deliberations of the I and II National Environment Conferences.

Several Government Programs were cited and requests made for their maintenance and/or expansionSweet Water Program/Zero Thirst, Program for a Million Cisterns, the San Francisco Basin Revitalization Program, the National Plan to Combat Desertification and Mitigation of the Effects of Draught. There were also several requests to determine an alignment and conjunction with the plans and actions of different ministries that work in the same areas.

Health

Discussions referred to research, prevention and control of diseases related to climate change and the combating of diseases that are mostly suffered by the poor. Within these proposals, the following are worth highlighting: monitoring and dissemination of data relative to air and water pollution; the creation of Emergency Action Plans for populations that are exposed to critical environmental events (floods, draught, hurricanes), that include the forecasting of weather events; the construction of a map of vulnerabilities and contingencies, and the promotion of the I National Conference of Environmental Health for 2009, with the collaboration of other ministers.

Coast and Marine Zones

The theme of coastal and marine zones centered its attention on the rise in the sea-level and a proposal for adaptation The main actions that deal with these concerns are: internationalization of territorial planning and management instruments in these areas; the creation of early warning systems, and the creation of a monitoring system, based on the example of Global System for the Observation of Oceans. Regarding the conservation of marine ecosystems and species, there were proposals to create a larger number of conservation units in the coastal zones and to strengthen the groups that study marine flora and fauna, as well as the implementation of a National Policy for Coastal Development.

Agriculture and Livestock

Proposals regarding this theme were directed to the promotion of sustainable management in agro-ecology by means of tax incentives and the establishment of special credit lines, as well as training the rural producer, with emphasis on family farmers and traditional communities. The most interesting proposals were: support for different institutions that develop research on the influence of weather in the aptitude of lands that are appropriate for production; the undertaking of studies that evaluate the short, medium and long term impacts on agriculture and livestock and supply systems; organization of agriculture and livestock systems in line with local water regimes; compensation for environmental services provided by traditional communities; implementation of a National Policy for Sustainable Development of Peoples and Traditional Communities and the creation of a Social-Environmental Development of Rural Family Production Program - PROAMBIENTE.

Natural Ecosystems

Proposals for the conservation and/or recovery of natural ecosystems addressed the creation of ecological corridors, the monitoring of the impacts of climate change by means of defining specific environmental indicators for each biomass, the establishment of urgent and permanent measures to reduce fragmentation of ecosystems and the impacts and threats that may reduce their capacity of adaptation when facing climate change. Proposals examined the effective application of ecologic-economic zonings (EEZ) and other territorial planning and ordering instruments as well as the search for the managers who would lead to the conservation of Brazilian ecosystems.

Environmental Education and Citizenship

The thematic axis on environmental education and citizenship captured the interest of many delegates and guests that attended the III CNMA. Within the varied proposals of the participants of this Working Group, the most important were: the institution of the National System for Environmental Education (SISNEA) must consider actions of mitigation and adaptation to climate change; an increase in the exchange of information amongst institutions so that these can become centers of excellence in the area of climate change; the identification of national and international partnerships for the exchange of information relative to environmental education; strengthening of the Let us care for Brazil Program in grade schools and the implementation of the Public Administration Agenda for the Environment (A3P).

Highlights

Preservation of the neo-liberal discourse

Other considerations offered during the conference deserve to be mentioned. One of these refers to the dual nature of the discourse in defense of the environment and the pressure exerted so that the elites of peripheral countries adopt neoliberal policies for deregulation. That is, there is a counter indication between conservationist discourses and, for example, the reduction of funds for auditing activities and a tolerance in relation to projects that cause enormous impacts on the environment.

At various moments and under certain proposals of the III CNMA, the differences between the concepts of economic growth and development were emphasized and repeated calls for indicators of sustainability of economic growth were heard. There is a lack of statistics and indicators relative to the environment in Brazil. The production of environmental statistics and historical series demand time and resources that are not always available in the poorest countries.

Another aspect that must be considered is that of the use of economic growth indicators as indicators of development. It has already been concluded that economic growth and development are not synonymous and that economic development cannot be sustainable. The use of indicators such as the GDP, for example, does not reflect development in a realistic manner in its calculations. There is a wide array of indexes, which may not constitute the best portrait of the development of a nation. This makes it necessary to advance in the development of more specific indexes that that fit the reality of each nation, so that both society and government have available methods to evaluate what sustains their type of development.

Environmental Evaluation and economic instruments

Another controversial question refers to the discussion regarding the importance of economic evaluation and environmental resources. Questions that refer to how to attribute economic value to natural resources, not only due to their relative scarcity, but due to the need to preserve them have been set forth. Certainly, these are serious challenges that must be faced in order to attain the desired sustainable development.

At the same time, some of the delegates stated clearly that it is necessary to increase oversight activities and strengthen the agencies that execute environment policy. There is a trend to adopt economic instruments to reward good practices and enhance change in patterns of utilization of natural resources. There is a need to adopt such instruments, which represent certain advantages (greater flexibility, individualization of the different potential of polluting agents, amongst others) when compared with management and control instruments. At no time is it possible to lose sight of the fact that both have very specific roles that must be performed within a policy that manages environmental resources.

In several sections of the basic text, it became clear that economic instruments and control are not mutually exclusive and complement each other if used as means to achieve a specific objective. Also, it is important to be alert to the potential danger of the substitution of management and control instruments by economic instruments, in the sense of a substitution of 'clean technology' - that expresses the concept of preventive actions - by 'clean techniques' - which refer to a corrective action for a damage caused to the environment.

Life Cycle and Sustainable Consumption

The Life Cycle Assessment (LCA) is a process that assesses the environmental impacts associated with the production of good. It is conceived for productive cycles (processes and/or activities), considering extraction and processing of raw materials, their manufacture, transport and distribution, use, reuse, maintenance, recycling or final disposal.

Several measures adopted by the international community were incorporated by delegates to the III CNMA proposals. These included the life cycle concept, waste management, and increase in energy efficiency.

It is essential to know the pillars of this process - State, industry and the consumer. Manufacturers must get to know the environmental profile of the inputs they incorporate into their products as well as designers, who must consider the impact of their selections and have easy access to existing data regarding life cycles and methodologies for the evaluation of impacts upon the environment, so that consumers can recognize products that are environmentally sustainable. A large part of this information does not exist or is simply unavailable, a clear indication that there is still a long road to be traveled in this sense.

Among the most interesting proposals, we can mention: industries must take over the responsibility for the entire life cycle of their products, from the raw material used to produce them until final disposal; the installation of new industries should be conditioned by the life cycle of their planned products; it is necessary to create a public fund destined to epidemiological studies and health of workers; a dissemination in the media of the worst polluters: to establish a business responsibility for residues on the basis of environment friendly certificates and the creation of credit lines for the integrated management of solid waste.

Rural Populations

The issue of rural exodus and urbanization in Brazil also appeared in the III CNMA in the manner of a proposal to review the concept of urban and rural areas by the Brazilian Statistics Institute (IBGE). A methodology that is used to measure urban population in Brazil, in many cases is inappropriate, since it considers as urban all those who reside in municipal venues, independent of the size of the population in that municipality, its demographic density and location. As a result, a degree of urbanization attributed to the country is greater than what can be observed, as well as the great exodus that is attributed to rural municipalities.

Decentralized Management of the Environment

A discussion related to the decentralization of the Environmental Policy of Brazil surfaced more than once at the National Conference on the Environment. In many cases, decentralization offers advantages that lead to a greater responsibility and better control by users and communities. According to the Federal Constitution of Brazil of 1988, the Union, the States and Municipalities are co-responsible for the management of the environment, acting in a complementary manner, within the scope of their competencies.

If we would undertake a retrospective and historical view of decentralization policies in Brazil, and we focus upon the analysis of the decentralization enshrined in the Brazilian Policy for the Environment, we would face the first obstacle: an institutional vulnerability of various states and municipalities, brought about by the meager social capital in them.

Beyond being a common reality amongst the municipalities of the Amazon Region, this fact can also be observed in many municipalities in the rest of the regions of Brazil. Several Municipalities (of these) do not even have environmental agencies, and if they do, they lack the necessary infrastructure to operate effectively and discharge their functions of oversight and monitoring of the environment. Added to this fact, there is a greater risk of cooptation of agencies, political representatives and social movements as we enter deeper into the area of municipalities.

Desertification

The fight against desertification and its interactions with the effects of climate change was another theme amply debated at the Conference on the Environment. The I National Seminar to Combat Desertification, held in Brasilia, which preceded the III CNMA, was attended by some 250 representatives of government, civil society, academia and of international organizations that work directly on projects and actions destined to the semi-arid lands of Brazil. Amongst the participants who attended the seminar, 51 were national delegates to the III CNMA, who assisted in examining and discussing the subject during the Conference.

The meeting provided a space to promote and expand social participation and mobilization for the analysis and revision of public policies, programs and projects to combat desertification and the mitigation of the effects of drought. In addition to evaluating the implementation of the National Program of Action to Combat Desertification and Mitigation of the Effects of Drought (PAN-Brazil) there was an ample discussion of strategies to adapt the program to the new realities of the semi-arid lands, within the context of climate change. The effects of these changes will have a greater incidence upon the poor populations that live in regions subject to desertification.

Areas Susceptible to Desertification (ASD) in Brazil are predominantly concentrated towards the Northeastern region of the nation, including semi-arid and sub-humid dry lands, some of them in areas of the States of Minas Gerais and Espiritu Santo. The problem affects 15% of Brazilian territory and a population of 31 million inhabitants. According to the Minister, international conventions that deal with environment problems caused by human actions and that are dedicated to Desertification and Mitigation of the Effects of Drought (UNCCD) have barely mobilized public opinion as well as the attention of local governments. Meanwhile, it directly affects more than two billion people, especially in the poorest regions of the planet. According to the Minister, “Brazil has a semi-arid region with serious problems that will be further affected by climate change and by the loss of biodiversity. It is necessary to guarantee resources and the political commitment to face these problems by promoting sustainable development within those regions”.

Importance of the III NEC

During the final plenary meeting of the III National Environment Conference, the Minister for the Environment, Marina Silva highlighted that the selection of the theme for this edition, Climate Change, was in itself a great challenge. She highlighted the participatory nature of the process for the construction of a Policy and National Plan for Climate Change.

In her speech, Marina Silva highlighted that the resolutions of the first National Environment Conference were and continue to be implemented by the Ministry for the Environment, and that these will attain a degree of 70% to 85% efficiency respectively, and reiterated the commitment for this to take place. She thanked the support received from society and delegates and pointed out that the great challenge of this century is to search for alternatives that might equate development with environmental preservation.

Brazilian Initiatives receive international attention

The Government of Brazil implemented several actions aimed at decreasing the emissions of Greenhouse Effect Gases (GEE), such as the Plan of Action for the Prevention and Control of the Deforestation of the Legal Amazon Region. According to the official information of the MMA, this plan contributed to a reduction of 59% of the accumulated rate of deforestation of the Amazon Region during these last three years, thus avoiding the emission of some 500 million tons of CO2. Another important action was the addition of alcohol to gasoline. It is estimated that, since 1990, there has been a reduction of 13 million tons of CO2 emissions.

The commitment to reducing total emissions by 10%, signed by Brazil, accelerated the phase-out of CFCs gases, from 2008 until 2012, will save the atmosphere an additional 360 million CFC gases. To the previously mentioned initiatives we can mention others being implemented in the country such as: Alternate Electric Energy Sources Incentive Program - PROINFA; the National Program for the Production and Use of Bio-diesel; the increase of the national flex fuel (gasoline with alcohol) vehicle fleet, which at present represents 70% of the total national production of vehicles. One of the greatest elements of interest of this Plan, presently undergoing Congressional debate, is the idea of using the money of the Oil Compensation Fund for mitigation and research. Another great step forward was the creation of the Brazilian research Network on Climate Change (Rede-Clima), led by the National Institute for Space Research (INPE) to generate and disseminate knowledge and technology relative to climate change.

The Brazilian Forum on Climate Change was created in 2000 with the purpose of engaging government agencies and civil society in the discussion of this pressing issue. Members of the Forum are 12 Ministers of State, the director-president of the National Agency for Water - ANA and representatives of civil society, operating under the stewardship of the President of the Republic. Most recently, in November 2007, the Presidential Decree that instituted the Inter-ministerial Committee on Climate Change, was issued, assigning the responsibility for the preparation of the National Policy on Climate Change and the National Plan for Climate Change.

Also, during that month, the Brazilian Corporate Plan for Greenhouse Effects Gases was officially launched, which will make available to Brazilian companies international tools and methodologies to undertake the second inventory of GEE and control the emissions of this sector. This Program is being developed by the Center for Sustainability Studies of the Getulio Vargas Foundation (GVF), in partnership with the Ministry for the Environment, World Resources Institute (WRI), the World Business Council for Sustainable Development (WBCSD) and the Brazilian Business Council for Sustainable Development (CEBDS).

At present, there is a discussion regarding the application of a methodology for the preparation of a national inventory for the sector Change of Use of the Soil and Forests. A first inventory was already made and the second one is programmed for 2009. Brazil was recognized through these inventories, since, without having the obligation to do so, it used the methodology of developed nations. However, it did encounter some difficulties due to the diversity of crops and the heterogeneous nature of regions.

During the IV Global Conference on Oceans, Coasts and Islands, held in Hanoi, Vietnam, several initiatives presented by Brazil caught the attention of countries that participated in the discussion of a global agenda for oceans. Among the initiatives presented, we can highlight the creation of the Secretariat for Climate Change, which brings into focus matters of the environmental quality of oceans in relation to climate change, initiatives for adaptation to a possible increase in the level of the seas in the country and a Macro-diagnosis of the coastal zones of Brazil, to be launched during the Environment Week, in commemoration of the 20 years of the National Plan for Coastal Management.

ANNEX IV: List of other regional documents and reports available separately

The following documents are available on FFLA's web site:

1. Overview papers and Powerpoint presentations for the Caribbean, the Andean Region and Mesoamerica.
2. Reports of the sub-regional consultations to experts and vulnerable communities.
3. RIDES Report on literature review.
4. Report of the Final Workshop (May 15-16th, 2008)
5. Experts' review reports from José Marengo, Holm Tiessen, Ana Rosa Moreno, Claudia Natenzon, Max Campos, Avelino Suárez, Allan Lavell, and Patricia Romero Lankao.

Also, a complete database of literature on Climate Change relevant to Latin America is also available in the same web site.

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