

# The consequences of climate change in the Americas

**Activities, lessons learned and  
recommendations for further work in Latin  
America**

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January 18, 2007**

# Global warming has dangerous consequences

(Anticipated impacts as temperatures increase)

- ▶ 0.6 C Wholesale Coral bleaching
- ▶ 0.6 C West Antarctic losing ice
- ▶ 1.0 C Rapid retreat of tropical glaciers in the Andes
- ▶ 1.6 C Onset of melting of Greenland
- ▶ 2-3 C Onset of changes in the Amazon rainforest ecosystem
- ▶ 4 C Possible collapse of Gulf current

▪ Source: Exeter Conference Final Report, Cambridge Press, 2005

# Regional impacts<sup>s1</sup>

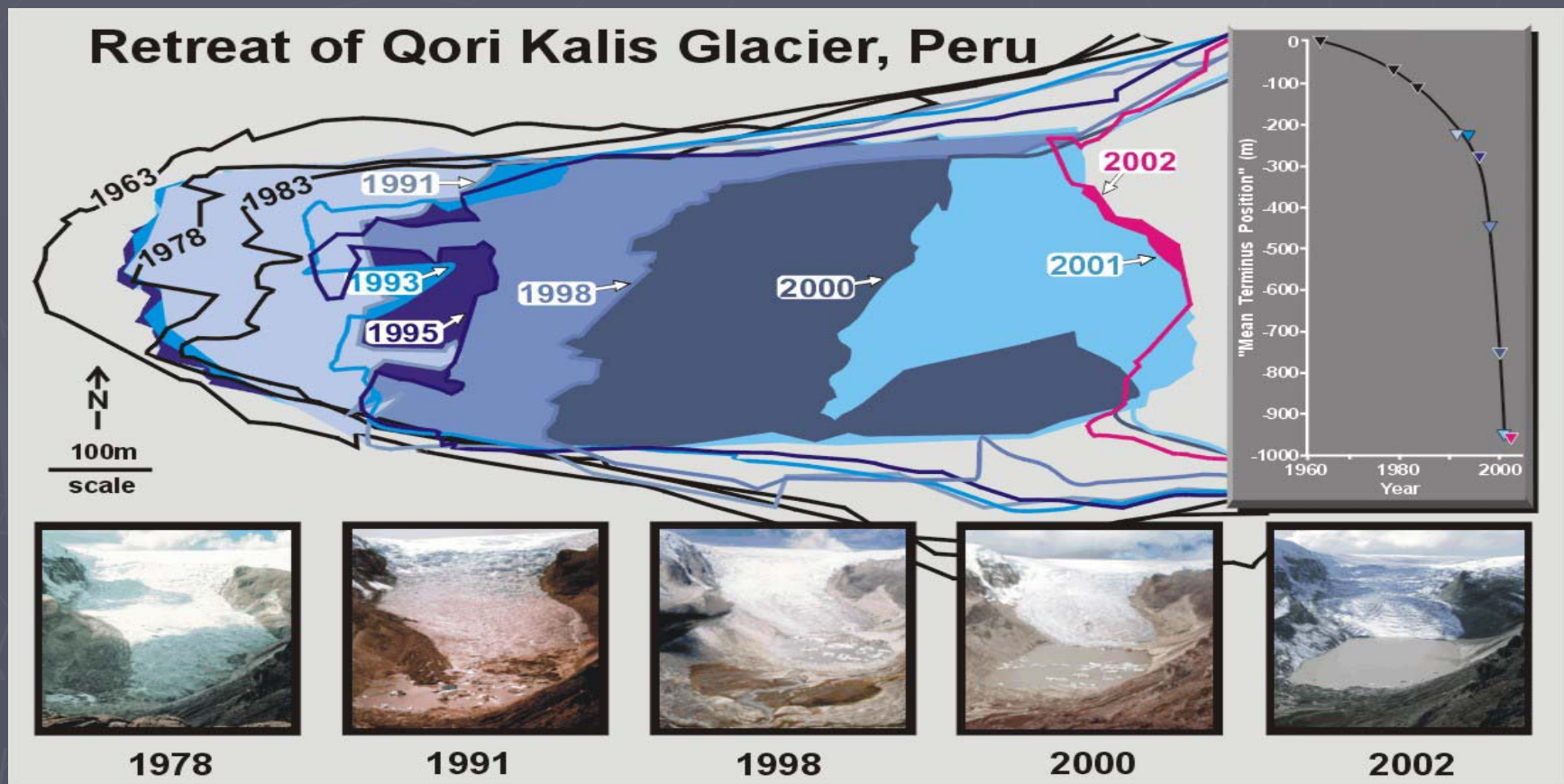


s1

pct

salcr007, 12/11/2006

Since 1970, glaciers in the Andes (Colombia, Ecuador, Peru, Bolivia, Chile, Argentina) have lost 20% of volume with serious immediate implications for water and power supply in the region



(Source: Thompson, 2005)

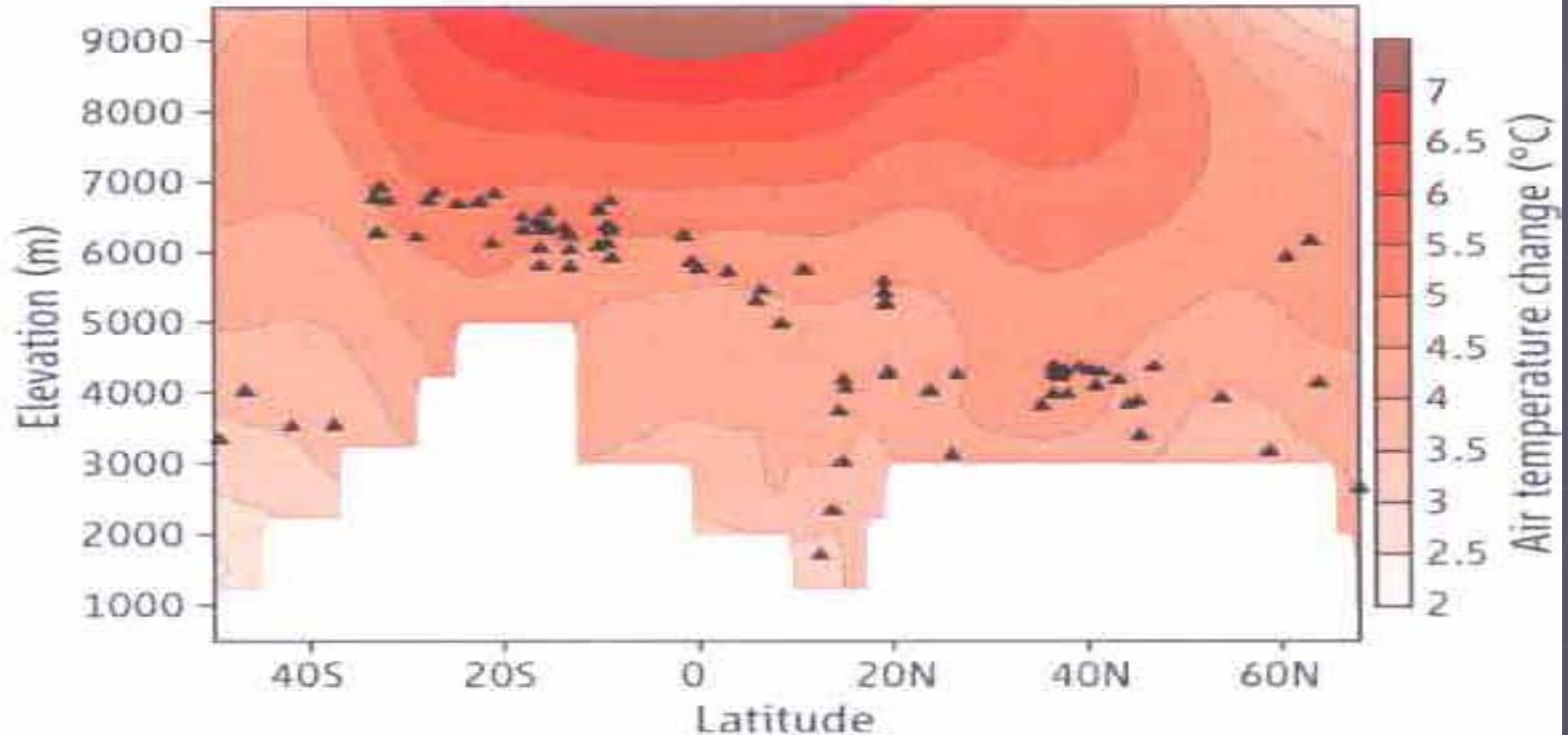
## Slide 4

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**BPRC1** Photos of the Qori Kalis outlet glacier taken in 1978, 1991, 1998, 2000 and 2002 show the retreat of the ice margin and the development of a lake. A map showing the position of the glacier terminus indicates that in the period between 1963 and 1978, the glacier was retreating on average 4.7 meters per year. Between 2000 and 2002, the average retreat had increased to over 200 meters per year or 40 times faster, and the retreat continues.

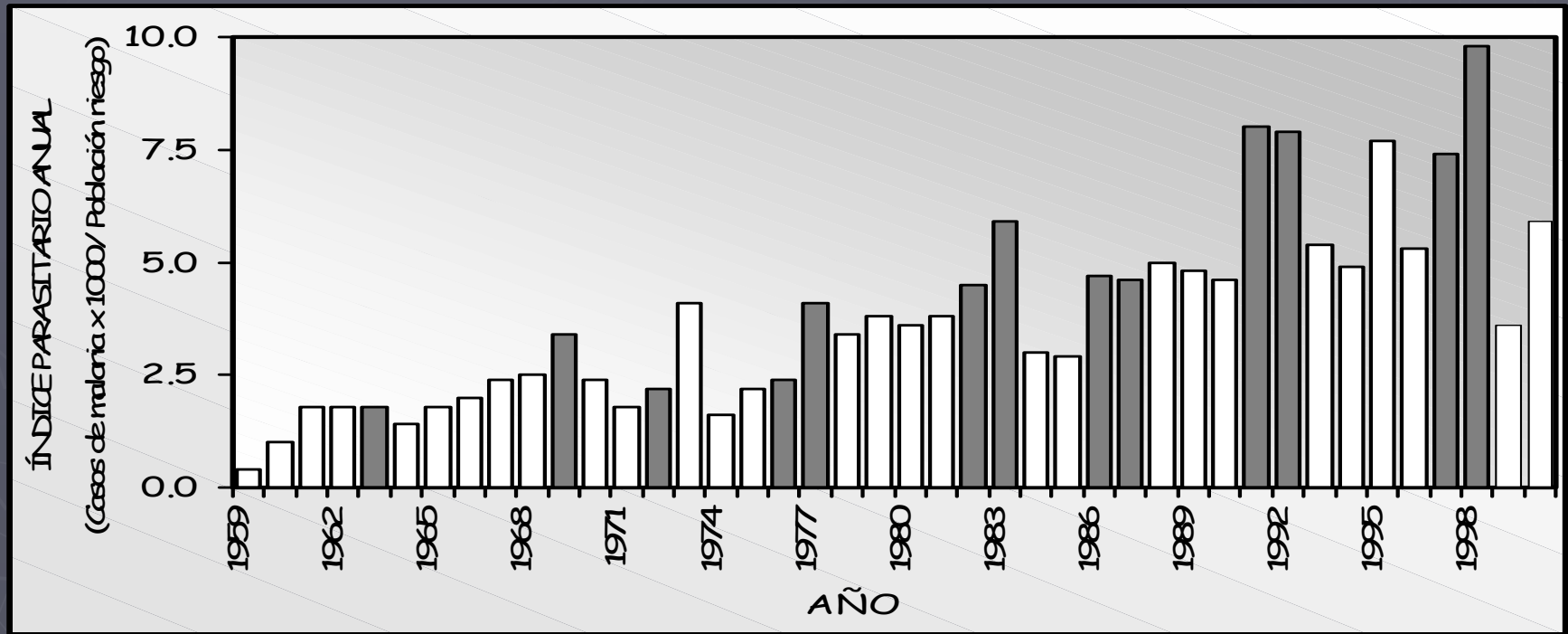
Byrd Polar, 3/24/2005

Temperature in the Andes is increasing faster than at sea level, affecting mountain habitats and promoting increased exposure to tropical diseases (In 2004, the Malaria vector was reported at 2000 m in Colombia)



**Global warming in the American Cordillera.** Projected changes in mean annual free-air temperatures between (1990 to 1999) and (2090 to 2099) along a transect from Alaska (68°N) to southern Chile (50°S), following the axis of the American Cordillera mountain range.

# Malaria incidence in Colombia has doubled since 1970 and shows linkage to climate changes



Grey bars are the El Niño years. (INS, 2005)

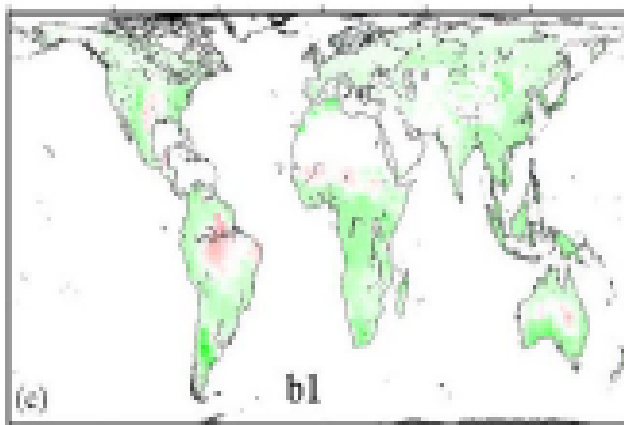
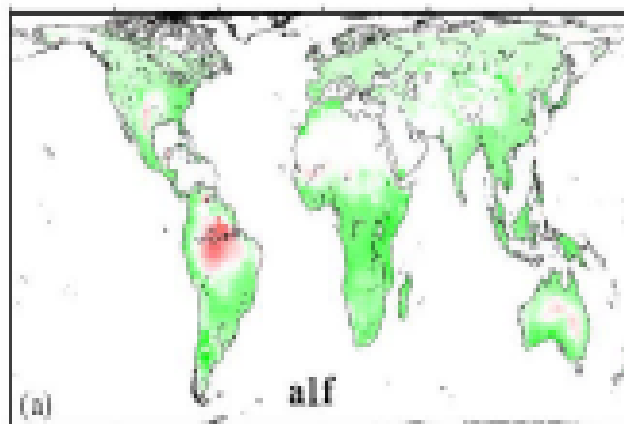
20 million people, live in areas where mean temperatures range between 15-26°C,. Within this area, an increase in mean temperatures of 2°C, is likely to result in a Significant increase in the exposure to Malaria and Dengue.



# Temperature increase of 4 C, is anticipated to lead to collapse of Amazon Rainforest Ecosystem

## Loss of impacted system

Change in carbon  
(Kg C m<sup>-2</sup>)



Complete loss of Amazon  
rainforest with temperature  
increase by 2100 of 4°C

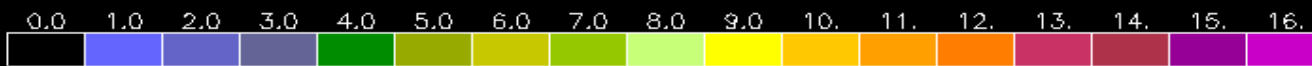
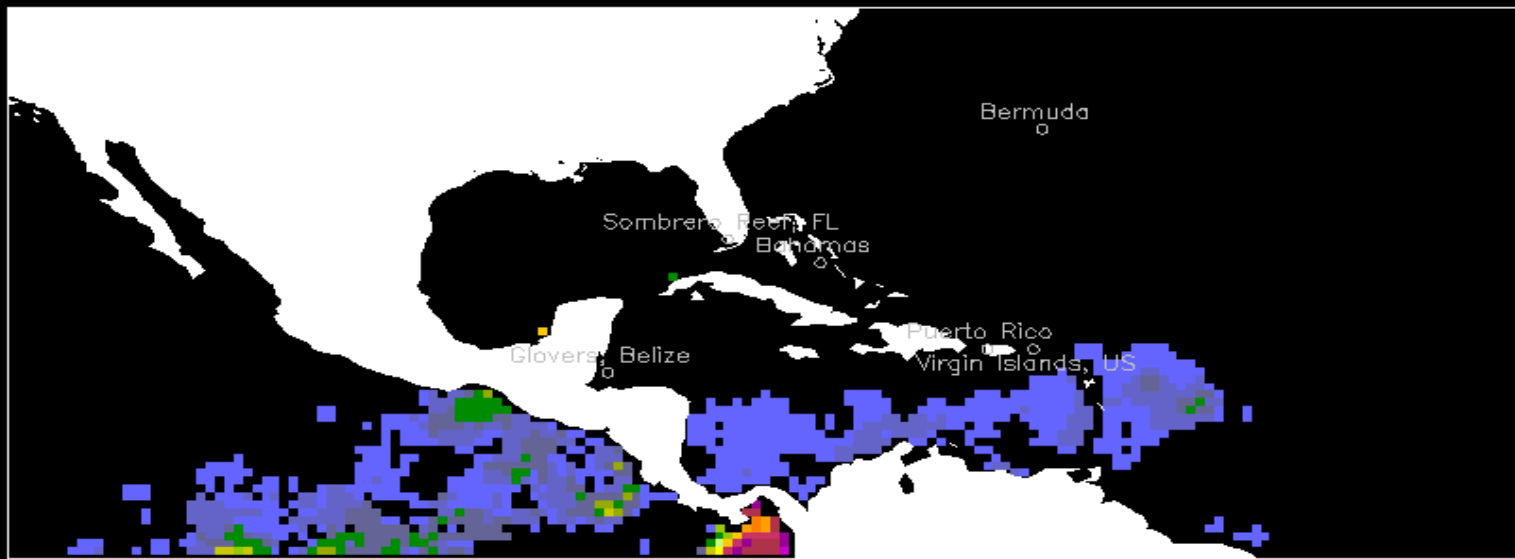
Partial loss of Amazon  
rainforest with temperature  
increase by 2100 of 2°C

Levy *et al.* (2004)

# Since the 1980s, corals in the Caribbean have experienced unprecedented mortality with anticipated lasting impacts on fisheries and tourism (2005 event)

NOAA/NESDIS Degree Heating Weeks for last 12 Weeks – 6/4/2005

DHW:  
Heating  
index,  
above light  
green: mass  
mortality



(Source: A. Strong, 2006)

\*(Degree Heating Weeks)

≥ 4 DHWs →

coral bleaching is expected

≥ 8 DHWs →

mass bleaching and mortality are expected

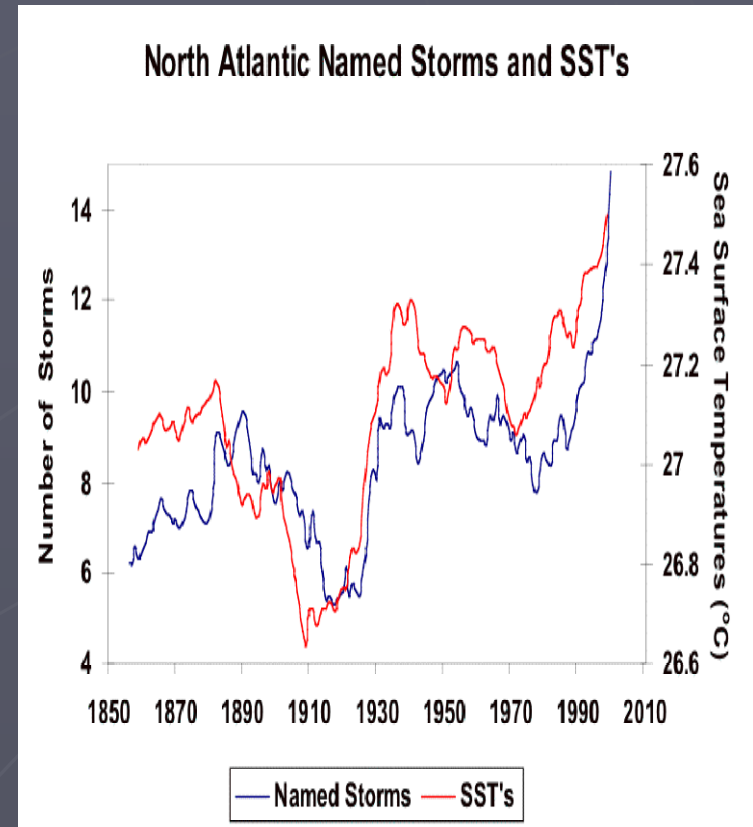
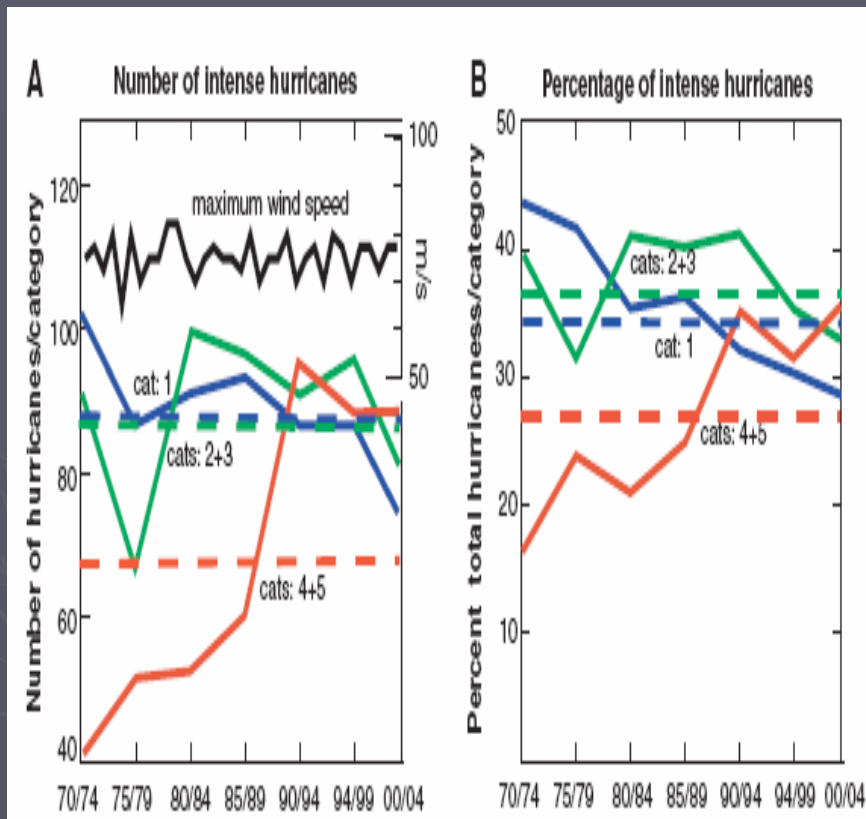
# The Gulf Coast of Mexico is very vulnerable to sea level rise.

(Coastal areas subject to flooding with 0.25 m increase in sea level)



(Source: Ortiz Pérez y Méndez Linares. 1999)

# Hurricane intensity has steadily increased since the 1970s in tandem with sea surface temperature (landfalls in the Caribbean basin have increased)



(Source: Webster et. al. 2005)

# The costs of hurricanes in Central America

Hurricanes/date	Affected Countries	Reported Damage	Damage Normalized to 1998 USD
Mitch/October 1998	Honduras Nicaragua El Salvador Guatemala	5-7 billion USD	5-7 billion USD
Joan/October 1988	Nicaragua Costa Rica Colombia Venezuela Panama	2 billion USD (1 billion Nicaragua alone)	3.3 billion (1.5 billion Nicaragua)
Francelia/September 1969	Guatemala	4.7 million USD	71 million

# Economic impacts from climate change in Caricom Countries

► Incremental costs by 2050(US\$1999 million/year)

	Low	High
■ Hurricane damage	160	610
■ Tourism	270	1,300
■ Infrastructure	990	6,600
■ Agriculture	*	*
■ Fisheries	*	*
■ Public health	(32)	(122)
■ Ecosystems	32	110
■ TOTAL	1.5 b	8.7b
■ % of GDP	5.6	34

CLIMATE TAX

■ (Source: WB unpublished data)

# Economic impacts from climate change in LAC by 2050

- ▶ Combined impacts of sea level rise, and loss of fisheries and tourism calculated to equal 5-30% of GDP in the Caribbean
- ▶ Water supply to cities will be affected (Quito may see water supply costs increase by 30 %, La Paz, Lima, Bogota also to be affected by diminished supplies caused by climate change)
- ▶ Power generation will be more expensive as it shifts from hydro to thermal
- ▶ Health costs will be affected by increased exposure to tropical disease
- ▶ The cost of hurricane impacts have increased by two orders of magnitude in the Caribbean basin in last 20 years and hurricanes are expected to continue increasing in intensity
- ▶ Loss of biodiversity and ecosystem integrity: priceless!

# Carbon footprint





# Global GHG emissions

Country	Total (BTA)	Ton/GDP ton/\$Mpp	Ton/cap
▶ USA	6.9	720	24.6
▶ EU-25	4.7	450	10.5
▶ Germany	1.0	470	12.3
▶ Japan	1.3	400	10.4
▶ China	4.9	1020	3.9
▶ India	1.9	770	1.9
▶ Mexico	0.5	590	5.2
▶ Brazil	0.8	680	5.0
▶ Argentina	0.3	660	8.1
▶ Total	33.6		

▶ Source: WRI, 2006

# Carbon Footprint of LAC (BTA)

▶ Total emissions of CO2 about 1.9 BTA

▶ Sector Volume

▪ Transport	0.38
▪ Power & heat	0.30
▪ Industry	0.25
▪ All others	0.37
▪ Total	1.30

▶ Other gases 0.6

▶ Deforestation ~2.0 BTA

- 532 million inhabitants, 8.5% of population, 6% of emissions,

Source: IEA, 2005, WRI, 2006

# Strategy



# Strategy on climate change in Latin America

## 1. Institutional strengthening and linking science to development

- ▶ Empower countries in region to play an active and influential role in the international climate agenda.

## 2. Mitigation

- ▶ Scale-up and mainstream in lending operations and analytical work
- ▶ Channel resources to promote reforestation and reduce deforestation

## 3. Adaptation: a clear first priority for Latin America

- ▶ Implement activities in key sectors that can illustrate the costs and benefits of adaptation as a springboard to unavoidable large scale adaptation efforts.

# Institutional Strengthening and Access to information

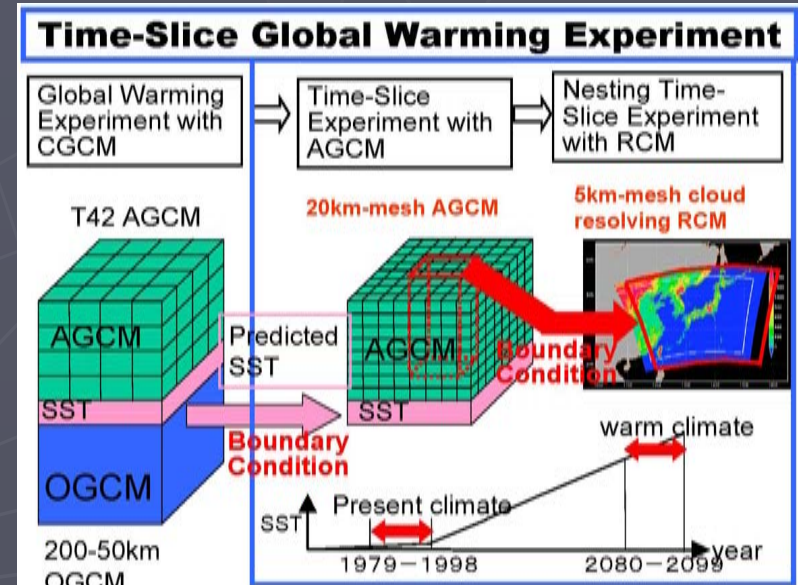
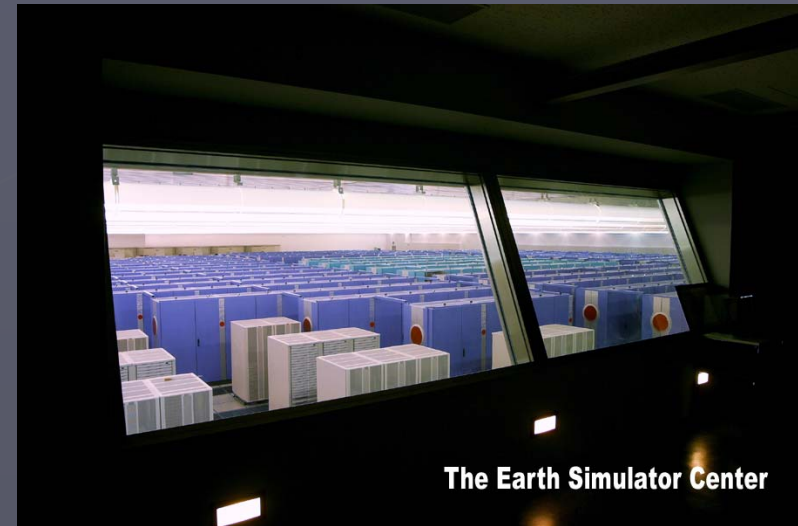
- ▶ Provide countries access to cutting edge science to empower the country counterparts to be more influential in the international discussion
  - Region has already agreements with leading scientific institutions worldwide; example: Earth Simulator
- ▶ Support institutions and efforts to mainstream climate concerns
  - CCCCC and offices in Colombia, Mexico, Bolivia and Argentina
- ▶ Assess costs and impacts of climate change
- ▶ Carbon Finance Assist to help with carbon market capacity building

# Earth Simulator

- ▶ **Scope of the Cooperation.**
  - training in Japan to enable efficient use of ES data
  - technical assistance to interpret results
  - scientific exchange
  - cooperation for dissemination of results in scientific literature
  - data storage
  - feedback to ES for better future simulation at regional level

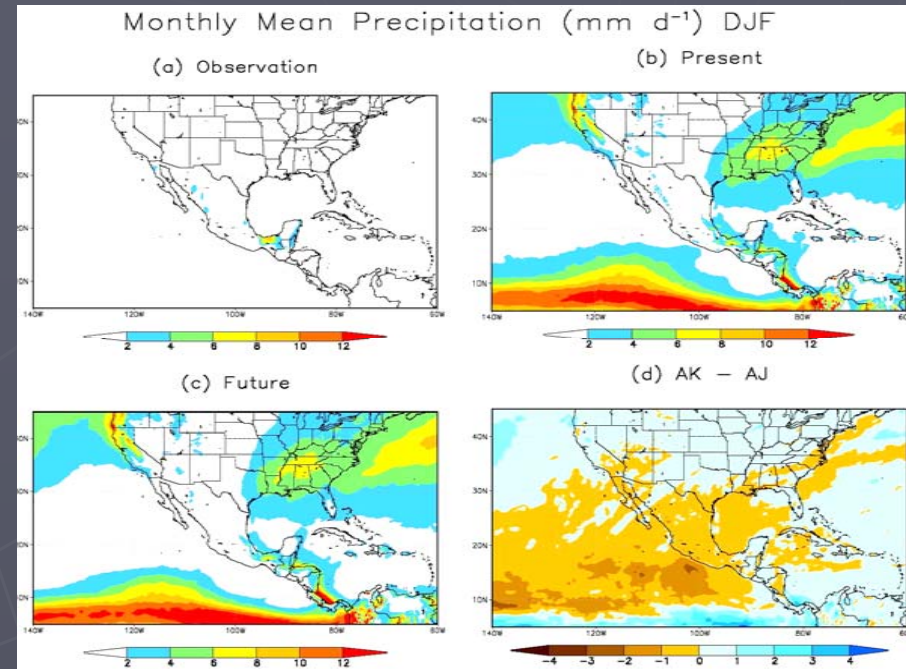
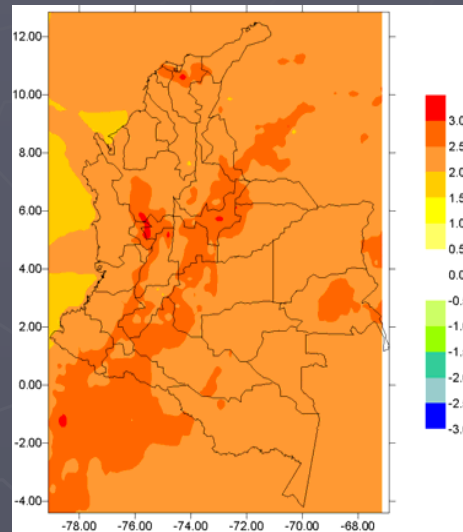
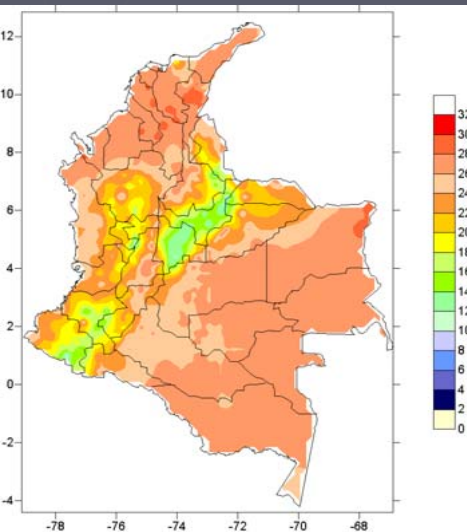
- ▶ **Architecture**

- 40 Teraflops!!!!!!!!!!
- 20 x 20 km grid resolution
- Future 5 x 5 km grid resolution



# Earth simulator results in LAC

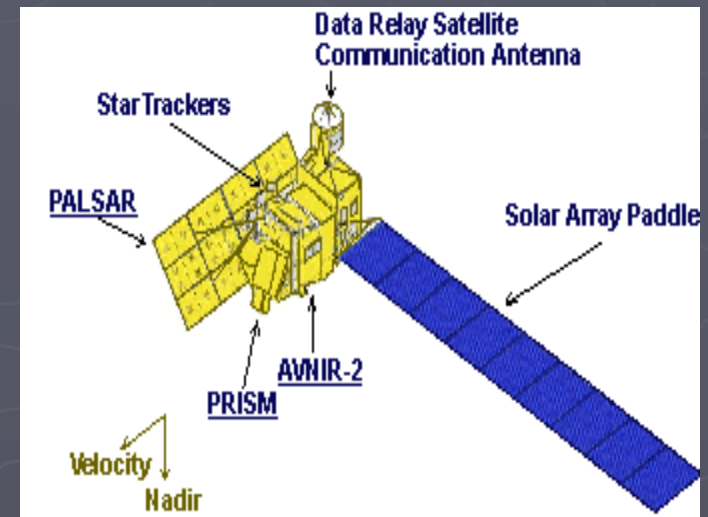
Examples: Much warmer temperatures over the Andes, significantly reduced winter rainfall over Mexico projected for the end of the century



Partnership MRI-World Bank-IDEAM, CCCCC, CONAM, INE

# Monitoring of glaciers and associated moorlands and coastal wetlands (US\$0.7 MM, CCIG)

- ▶ Design, install and operate 12 field stations in glacialized basins and wetlands of immediate economic relevance
- ▶ Remote sensing (ALOS)
  - Radiometer with 2.5m spatial resolution
- ▶ Support the operation of the network for three years



ALOS started observations  
On October 24, 2006



# Mitigation

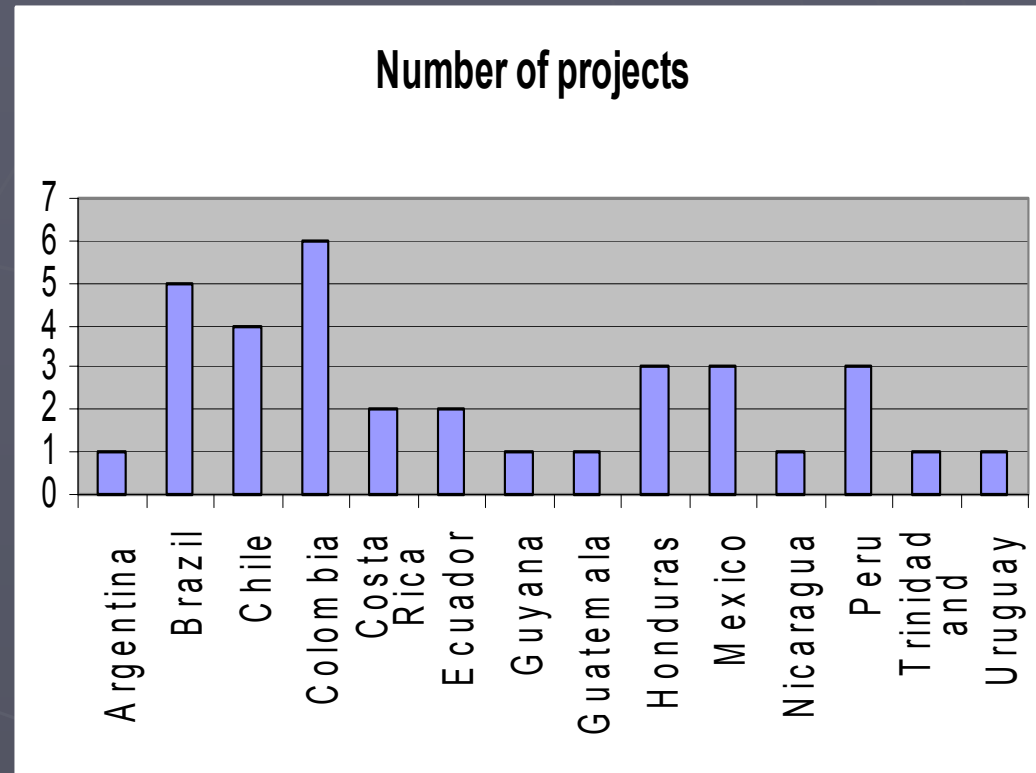
- Bank is the leader in carbon finance

- manages US\$ 1.93 billion in 9 carbon Funds involving 13 governments, 62 companies

- LCR has the largest number of carbon finance operations in the Bank

- 59 projects

- 10% emission reduction have a US\$1.4 billion/year market value

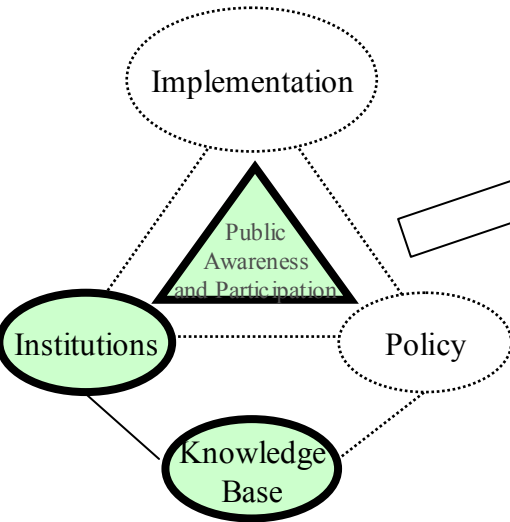


# Region is also the leader in Adaptation efforts in the Bank

- ▶ Largest portfolio in the Bank (90% of projects, 95% of resources), focused on key immediate impacts but funding is very limited.
  - Colombia: Integrated National Adaptation Project (health and changes in mountain habitats)
  - Regional Andes: Reduction of vulnerability to rapid glacier retreat
  - West Indies: Adaptation to impacts in coastal zones
  - CARICOM: Mainstreaming adaptation to climate change
  - Central America: Measures to adapt to intensification of hurricanes
  - Guyana: Adaptation to sea level rise
  - Mexico: Adaptation to climate impacts in Gulf of Mexico Coast

## CPACC

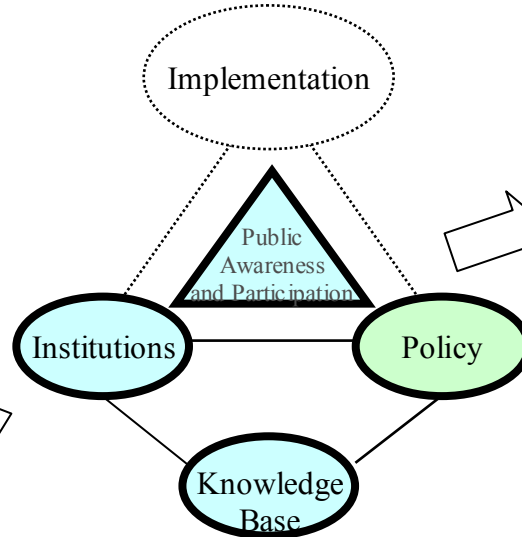
**Building awareness and strengthening knowledge base**



- Building Awareness.
- Building monitoring and analysis capability
- Building planning capacity in institutions

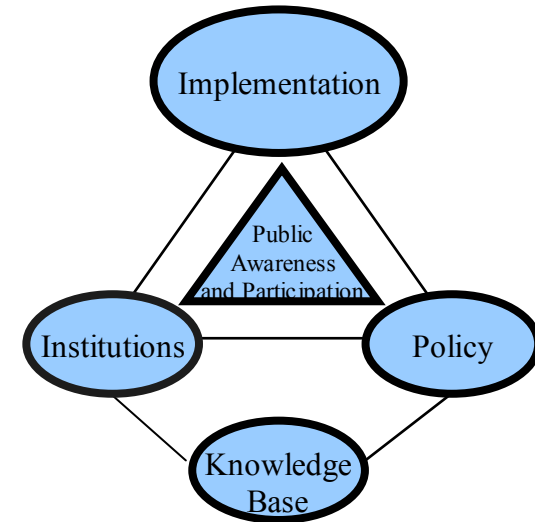
## MACC

**Creating an enabling environment for adaptation**



- Developing national policy framework for adaptation.
- Mainstreaming climate change issues into key sector activities.
- Preparation of pilot adaptation projects.
- Further strengthening of awareness and participation.
- Further strengthening of knowledge base

## Adaptation



- Policy framework for adaptation in place
- Projects being implemented.
- Awareness and participation high.
- Monitoring, analysis and planning integrated throughout all national and sectoral planning.

# Adaptation measures in coastal zones of the West Indies (SPA-US\$7 m)

- ▶ **Measures addressing impacts of climate change on coastal and near-coastal areas.**
  - Water water desalinization using wind energy for the Islands of Bequia and Union (St. Vincent & the Grenadines)
  - Strengthened critical coastal infrastructure in the Castries area (St. Lucia).
  - Approved: Sept 6, 2006

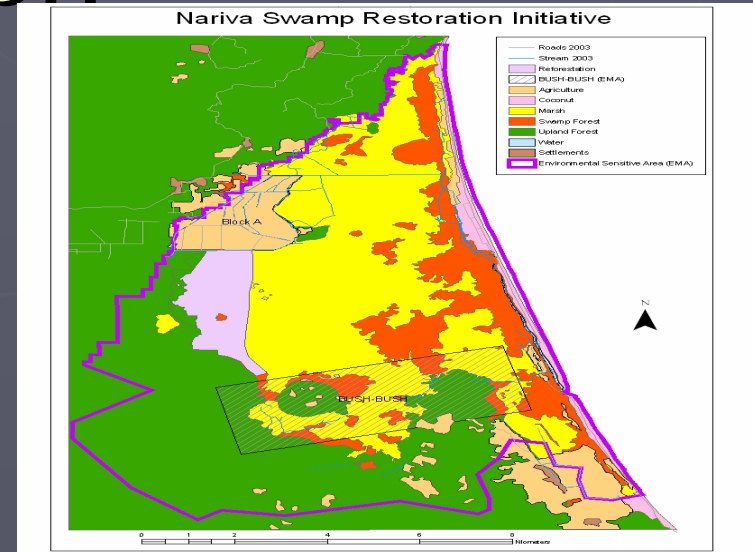
# Combining adaptation and mitigation

► Nariva ecosystem restoration in Trinidad (CF: E\$2m; CCIG: \$0.5 m).

- Restore natural drainage
- Restore soil cover
- Prevent fires

► A restored coastal ecosystem:

- Will:
  - promote carbon sinks
  - protect biodiversity
  - provide buffer to storm surges



# Mexico: Gulf Coast Wetlands— US\$28m-SCCF

- ▶ Assess climate impact on national water budget assessment
- ▶ Address impacts from subsidence and salination on the Gulf Coast of Mexico:
  - Restoration of natural surface drainage
  - Rationalization of water use
  - Regeneration of soil cover
  - New set asides
- ▶ Scheduled for GEF approval

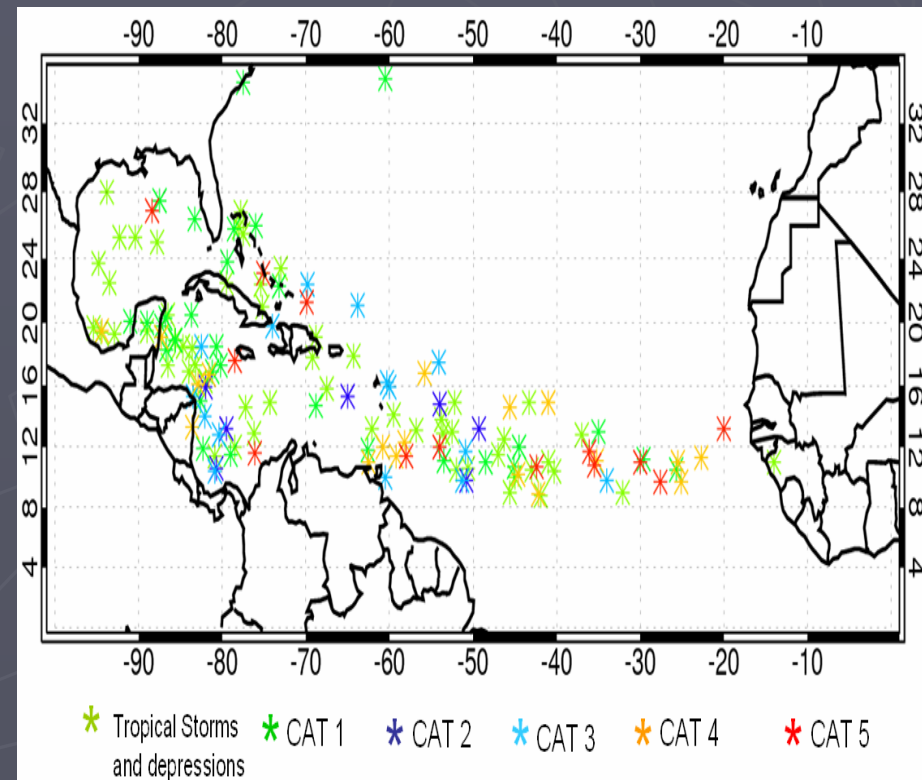
July 07

Figure 2. Vulnerability of Coastal Wetlands to Sea Level Rise



# Measures to adapt to intensification of hurricanes in coastal Central America: US\$24 m, SCCF (CCAD)

- ▶ a) coastal ecosystem restoration;
  - b) hillside reforestation and soil stabilization;
  - c) zoning; and
  - d) strengthening of critical coastal infrastructure
- Area: Belize to Costa Rica



# Next steps





# Suggested next steps for deforestation

- ▶ Support design of new avoided deforestation instrument (with external stakeholders)
  - Pilot activities: Brazil (Amazonas) and Mexico
- ▶ Strengthen debt swaps for forest protection
- ▶ Mainstream deforestation into development loans (structural operations)
- ▶ Support expansion of scope and size for BioCarbon Fund, focused in Latin America

# Suggested next steps for Adaptation

- ▶ Mainstream climate into national and regional policies and development activities (ministries of finance and planning)
- ▶ Link ecosystem restoration and climate change adaptation
- ▶ Exploit synergies between mitigation and adaptation
- ▶ Develop new instruments:
  - Structural operations to position economy to face climate change
- ▶ Apply common approach and link disaster management and adaptation

# Climate change central to the Bank's mission in the region

- Bank to assist in coordinated regional position on second commitment period (Post-Kyoto)
- Bank to trigger joint positioning by regional Banks and donors in the region with an aggressive stand on climate concerns
- Bank to act as conveyor belt of knowledge and information

# Regional emphasis

## ► Adaptation

- Caribbean and Central America: Focus on adaptation and disaster management
- Andes: Focus on water, energy, health, exploit renewable energy
- Argentina, Brazil: Impacts on agriculture

## ► Mitigation

- Brazil and Mexico: Focus on avoided deforestation and mitigation opportunities (energy efficiency, energy framework, renewable, industrial, SWM)
- G-34 agenda – balance of adaptation and mitigation with focus on local development priorities