Impacts of glacier retreats in The Andes



Source; Cobos, 2002

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Present status of glaciers in the Andes:

Snow and Glaciers are contributing melt water to many rivers along the Andes with benefits to:

•Indian communities (mainly in the Tropical Andes and Highlands)

•Peasants and other forestry/agriculture/livestock activities

•Mining activities

•Hydroelectric power generation

Tourist activities

•Water consumption in many cities (Quito, La Paz, Santiago)

Glacier melt water resources are already under stress by:

Natural variability

- •Strong competition for water rights allocation
- •Economic growth and farming expansion

•Poverty, pollution and lack of environmental concern

•Mining activities

Widespread glacier retreat is already affecting water resources availability with social, environmental, cultural and economic impacts

South American glacier inventories Updated to year 2009;



Sources: INRENA, IDEAM; INAHMI, GTNH, CECS, USGS



Cumulative mass balance on glaciers in Bolivia and Ecuador. Note that the hydrological year is September– August in Bolivia and January– December in Ecuador.

Souce: Vuille et al. (2008)

Area changes in the Tropical Andes

Country	Periods	Ice losses	Reference
(region)			
Colombia	1950-2000	50%	Ceballos et al, 2006
(National inventory)	1985-2000	10-50%	2000
Ecuador			
(National inventory)	1997-2006	28%	Cáceres et al, 2009
Peru			
(Cordillera Blanca)	1970-1998	12%	INRENA Jesús Gómez
(Glaciar Pastoruri)	1995-2008	40%	UGRH, Huaraz
Bolivia			
(Tuni-Condoriri)	1956-2006	50%	Edson Ramirez, 2008
Total tropical			
Andes	1970-2002	15%	Kaser and Osmaston, 2002

Glaciar Pastoruri. Peru









This glacier lost 40% of its area in the last 13 years;

Source: Jesus Gomez, UGRH, Huaraz, Peru

Glacier area reduction in central-northern Chile



Changes in western Patagonia





An increased number of ice-dammed lake outburst events have taken place

Area loss: 140 km² (3% of the NPI original area)

Source: Rivera et al, 2007

Recent conflicts in the region related to glaciers



Source: Azocar and Brening, (2008)





Souce: UGRH, Huaraz (2009)

Projected temperature changes along The Andes



Fig. 11. Projected changes in mean annual free-air temperature for a) 2026–2035, b) 2046–2055, c) 2066–2075 and d) 2090–2099. All Panels show departure from 1990–1999 average along a transect from Alaska (68°N) to Patagonia (50°S), following the axis of the American Cordillera mountain chain. Results are the mean of eight different general circulation models used in the 4th assessment report (AR4) of the Intergovernmental Panel on Climate Change (IPCC) using CO₂ levels from scenario SRES A2. Black line denotes mean elevation along transect; white areas have no data (surface or below in the models).

Source: Vuille et al, 2008

Present and future glacier area shrinkage in Bolivia





Many more glaciers will disappear in the next 20-40 years i

Source:

Edson Ramirez, USM;

La Paz, Bolivia

Summary

- **The bad news**: Andean glaciers have been shrinking rapidly in response to climate changes. This retreating trend seems to be accelerating in recent years, causing an increased number of GLOF events among other consequences.
 - Wasting ice is affecting water resources availability, especially in Tropical Andes and in the semi-arid regions of Argentina and Chile.
 - An increase in glacier melt water runoff has been detected, however all models are forecasting a mid/long term runoff reduction.
 - Environmental conflicts and social unrest are already taking place in the region due to; high competition for allocation and use of glacier melt water rights, mining activities and hydropower generation.

Summary

- The good news: Our national governments are having a better idea about this problem, proposing new institutions, policies and funds.
 - New water authority in Peru
 - A new Tropical Andes world Bank project
 - New glacier policy and fresh research funds in Chile
 - Enhanced and empowered environmental/water agencies
- However, much more is urgently needed at local, national and global levels (Copenhagen; post Kyoto agreement)

Thanks for your attention.....



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