An RHP for the Andes-Amazon System

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Acknowledgements:
These slides have been updated from an abridged version of the talk:

Ecosystem Sustainability and Poverty Alleviation in the Amazonia/Andes Region (AMAR): A Preliminary Scientific Framework for Catalyzing System Changes

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Rationale (1)

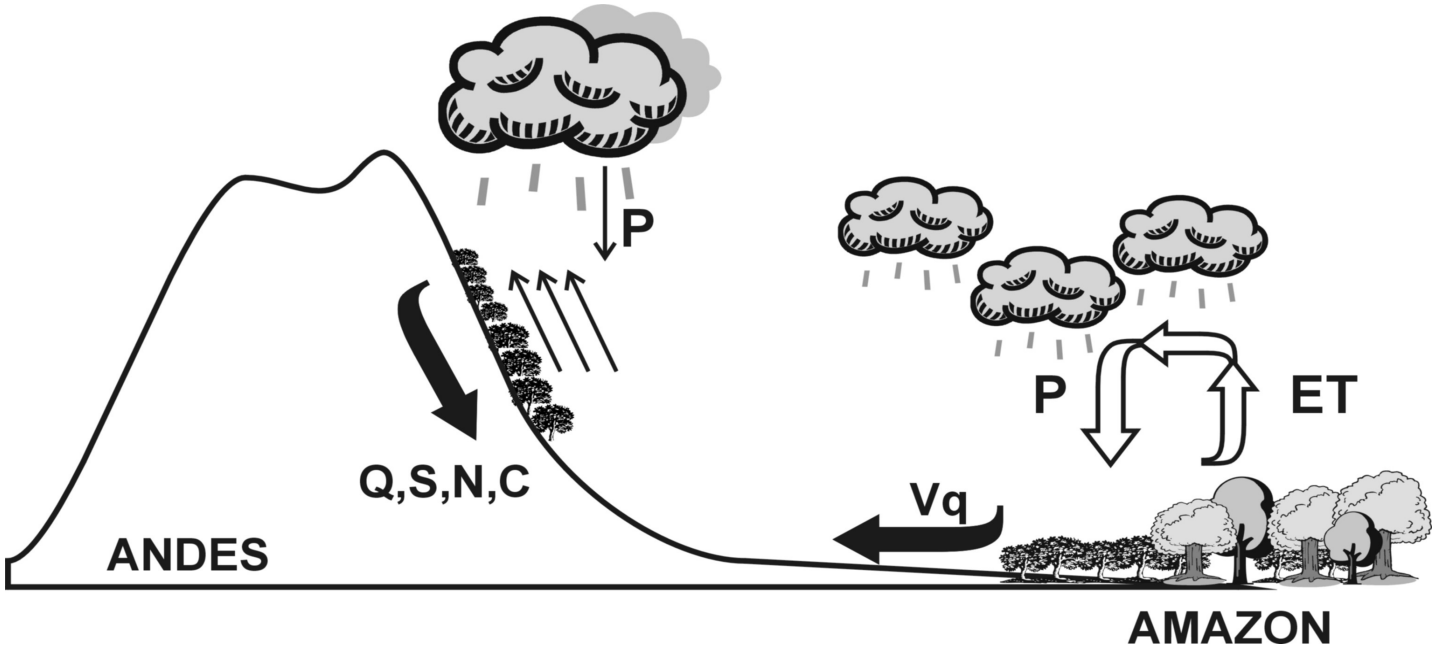
lThe mountainous areas of the tropical Andes harbour major cities like Bogotá, Quito, La Paz, Medellín, Cali, Cajamarca, Cuzco, Arequipa, San Cristobal, Riobamba, Ambato, Ayacucho, Huancayo, Oruro, Cochabamba, and hundreds of medium and small sized towns and villages that demand an ever increasing supply of natural and socio-economic resources and services.

lA degraded environment feeds back on the well-being of human communities, in terms of its failure to provide natural resources such as fresh drinking water and a sound agricultural basis. A degraded environment is also less able to respond to climate change, and the countries of Andes-Amazon region are particularly vulnerable in that regard, dependent as they are on the each other's conservation policies and practices.

lIn spite of the large body of scientific research and accomplishments of the Large Scale Atmosphere-Biosphere Experiment in Amazonia (LBA), no concomitant research efforts have been developed to link the hydrological, ecological, bio-geochemical and climatic dynamics of the Amazon River basin with its Andean headwaters, let alone to study the interactions between their natural and social systems.

lIt is impossible to understand the functioning of the Amazon River basin without a proper consideration of the upper Amazonia up to the Andean Glaciers. The low-lying Amazonia and the Andes conform a coupled system, and deforestation at both ends could cause a collapse in the functioning of the system.

Hydro-climatological Feedbacks between Andes & Amazonia



Poveda et al., *Paleo-3* (2006)

Rationale (2)

lA thorough understanding of the Andes-Amazon system is necessary, including the functioning of their natural ecosystems, as well as their interactions with social systems.

lIncreasing poverty in the region, disappearance of native and ancestral cultures, human encroachment, large scale deforestation, erosion and land degradation, landslides and debris flows, increasing vulnerability and risk of human populations and settlements, accelerated loss of biodiversity and soils, large-scale pollution of water sources owing to mining activities, oil industry activities, agriculture, cattle dwellers, tourists, coca growers, makes it all the more urgent that basic studies and applied research.

lAn increase of water-borne and climate-driven diseases (i.e., malaria, dengue) imposes serious challenges to regional development.

lA suite of opportunities arise from the region's natural biodiversity, as well as from the importance and breadth of current and potential environmental services provided by their ecosystems, and the considerable possibilities of sustainable development.

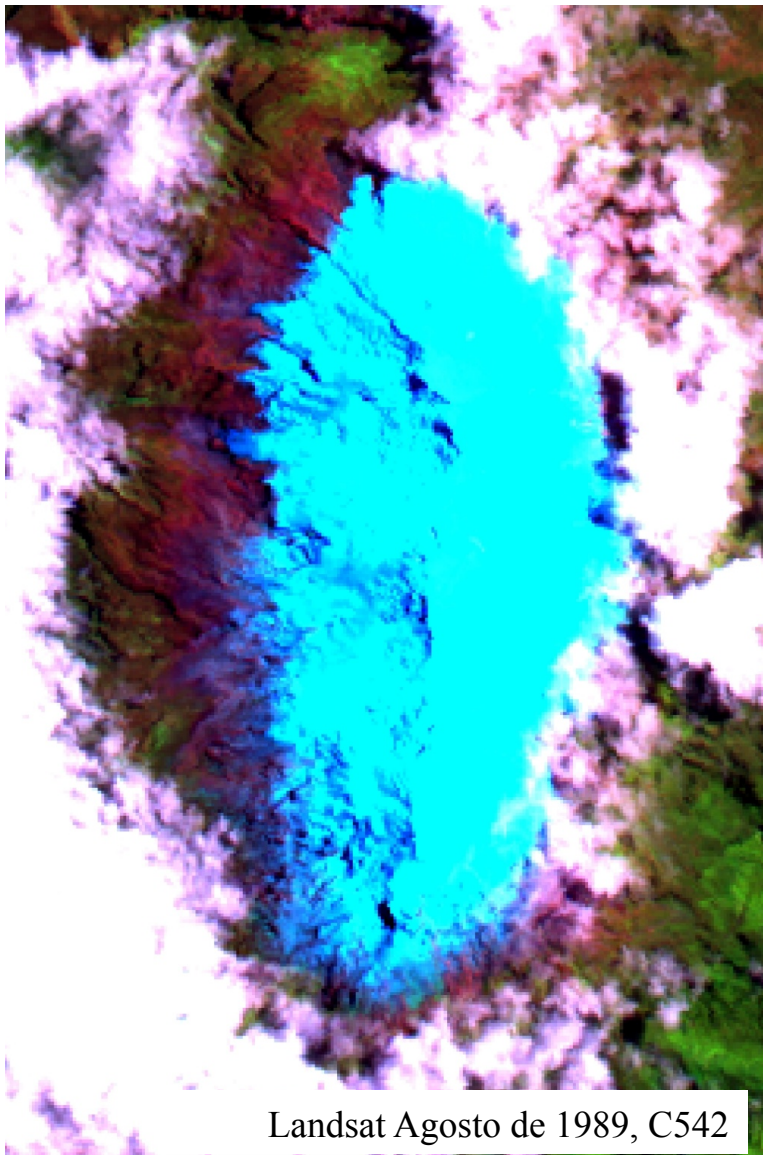
lIt is necessary to create a new paradigm for development of that region, one that contemplates a large focus on conservation, valuing ecosystems services, but allied to sustainable management and rational exploitation of economic value of biodiversity for the improvement of the livelihoods of the region inhabitants.

Research Topics

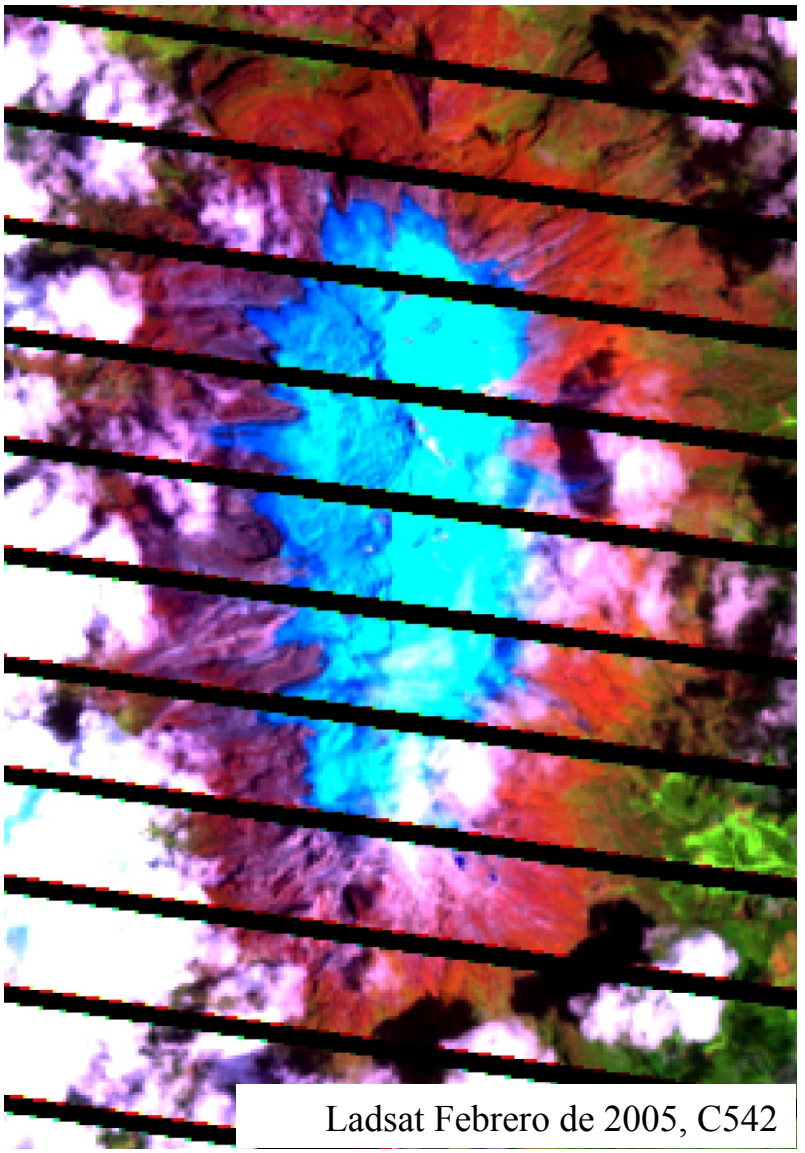
1. Climate change impacts on Andean glaciers, paramos, punas, and cloud forests and their impact on the hydrologic cycle and water supply.
2. Risk, Vulnerability, Environmental Degradation in and caused by Andean cities.
3. Water, energy and carbon budgets along the Andes-Amazon gradients, their feedbacks at a wide range of space-time scales and the effects of climate variability and change.
4. Socio-environmental vulnerability of the Andes/Amazon region and the impacts of climate change and land use-land cover change.
5. Mechanisms to prevent further deforestation and environmental degradation of the Andean region through sustainable and rational exploitation of natural resources including water, biodiversity, forests, fisheries, and agriculture to improve the livelihoods of the region's inhabitants.

1. Climate change impacts on Andean glaciers, páramos, punas, and cloud forests and their impact on the hydrologic cycle and water supply

Nevado del Huila, Colombia (1989-2005)



Landsat Agosto de 1989, C542



Ladsat Febrero de 2005, C542

Glacier Retreat Rates in Colombia

Glacier	Loss (%)	Period	Remaining area (km^2)
Sierra Nevada de Santa Marta	41	1989-2007	6
Sierra Nevada del Cocuy	40	1989-2007	17
Nevado del Ruiz	38	1989-2004	8.5
Nevado de Santa Isabel	49	1989-2004	4
Nevado del Tolima	24	1991-2004	2
Nevado del Huila	58	1989-2005	8

Pineda y Poveda (2007)

Changes in Surface Area Ecuador and Bolivia Glaciers

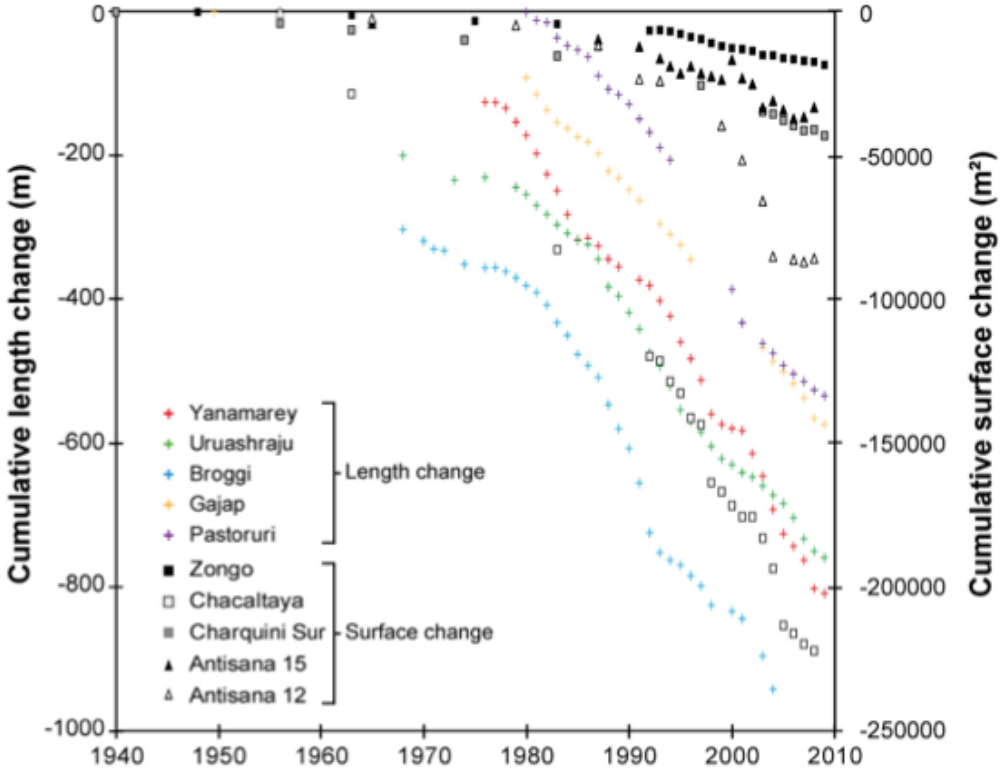


Fig. 5. Changes in surface area of five glaciers in Ecuador and Bolivia, and in length for five Peruvian glaciers. Observations of changes in length start in 1949 except for Pastoruri Glacier (1980). Observations in changes in surface area start in 1940 in Bolivia and 1956 in Ecuador.

Rabatel et al. (2013)

Changes in 8 Glacier Surface Cordillera Real, Bolivia, 1650-Present

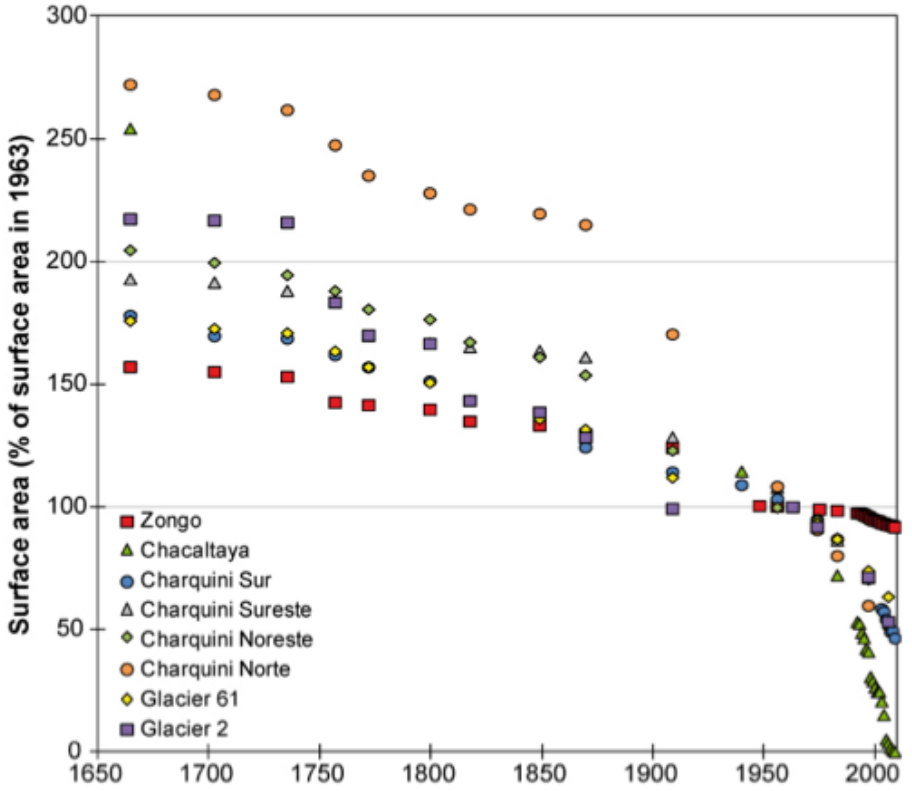


Fig. 3. Changes in the surface area of eight glaciers in the Cordillera Real, Bolivia, since the LIA maximum, reconstructed from moraine stages (LIA maximum and before 1940) and aerial photographs (1940 and after). 1963 was chosen as the common reference. Data are from Rabatel et al. (2006, 2008a) and Soruco et al. (2009a).

Rabatel et al. (2013)

Mass Balance Lost Andean Glaciers

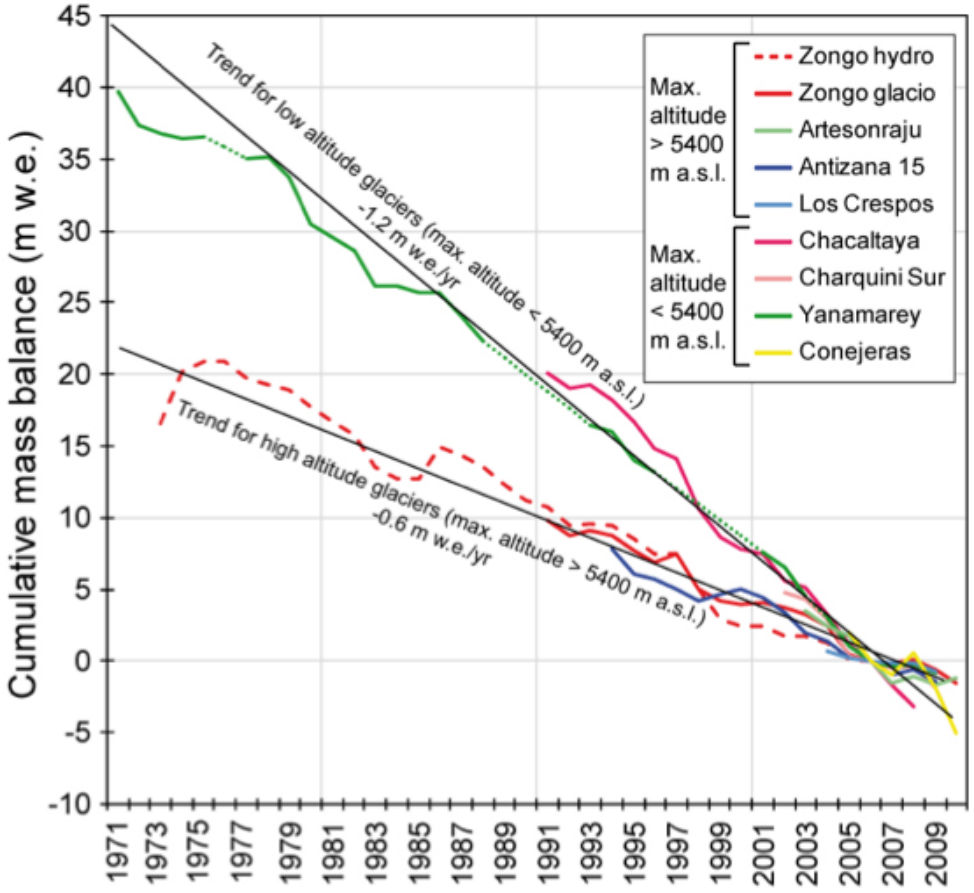


Fig. 6. Cumulative annual mass balance series computed for eight glaciers in the tropical Andes. 2006 was chosen as the common reference.

Rabatel et al. (2013)

Fate of Paramos, Yungas, Punas, & Cloud Forests?

Vanishing glaciers in the Colombian Andes[47] [48]

1946 2006 2021?

Photos: (from left to right): Erwin Kraus (1946, reprinted with permission from Diego Samper Editores); Oliver Hill / Roberto Ariano (2006), and; Photshop editing courtesy of John French (2006).

2. Risk, Vulnerability, Environmental Degradation and Poverty in and caused by Andean cities

Deforestation in the Andes:
Socio-Environmental Risks and Vulnerability

Deforestation in Andes
photo Paul Salaman

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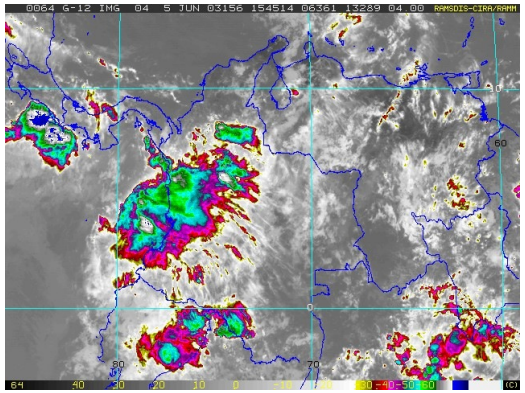

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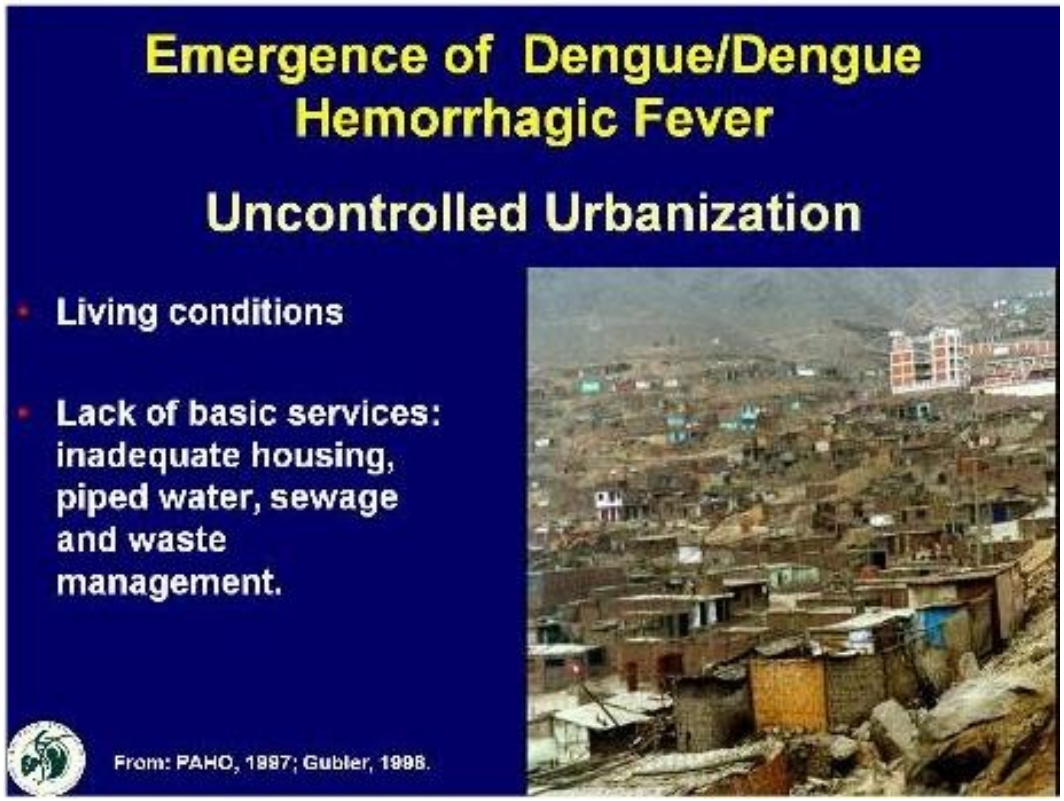
Climate Change and Human Health

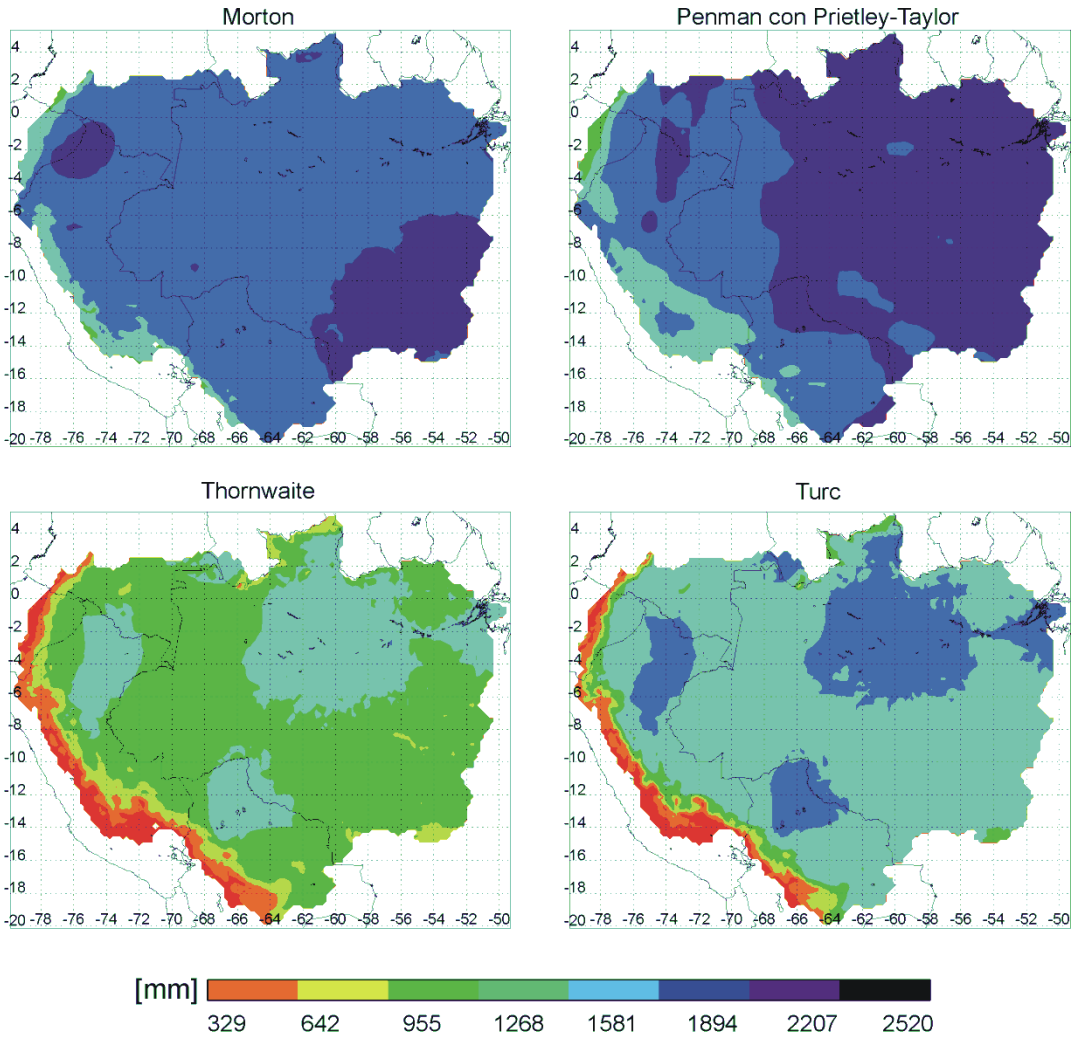


From: Duane J. Gubler, University of Hawaii

3. Water, energy and carbon budgets along the Andes-Amazon gradients and their feedbacks at a wide range of space-time scales. Effects of climate variability and climate change.

Long-Term Water Balances

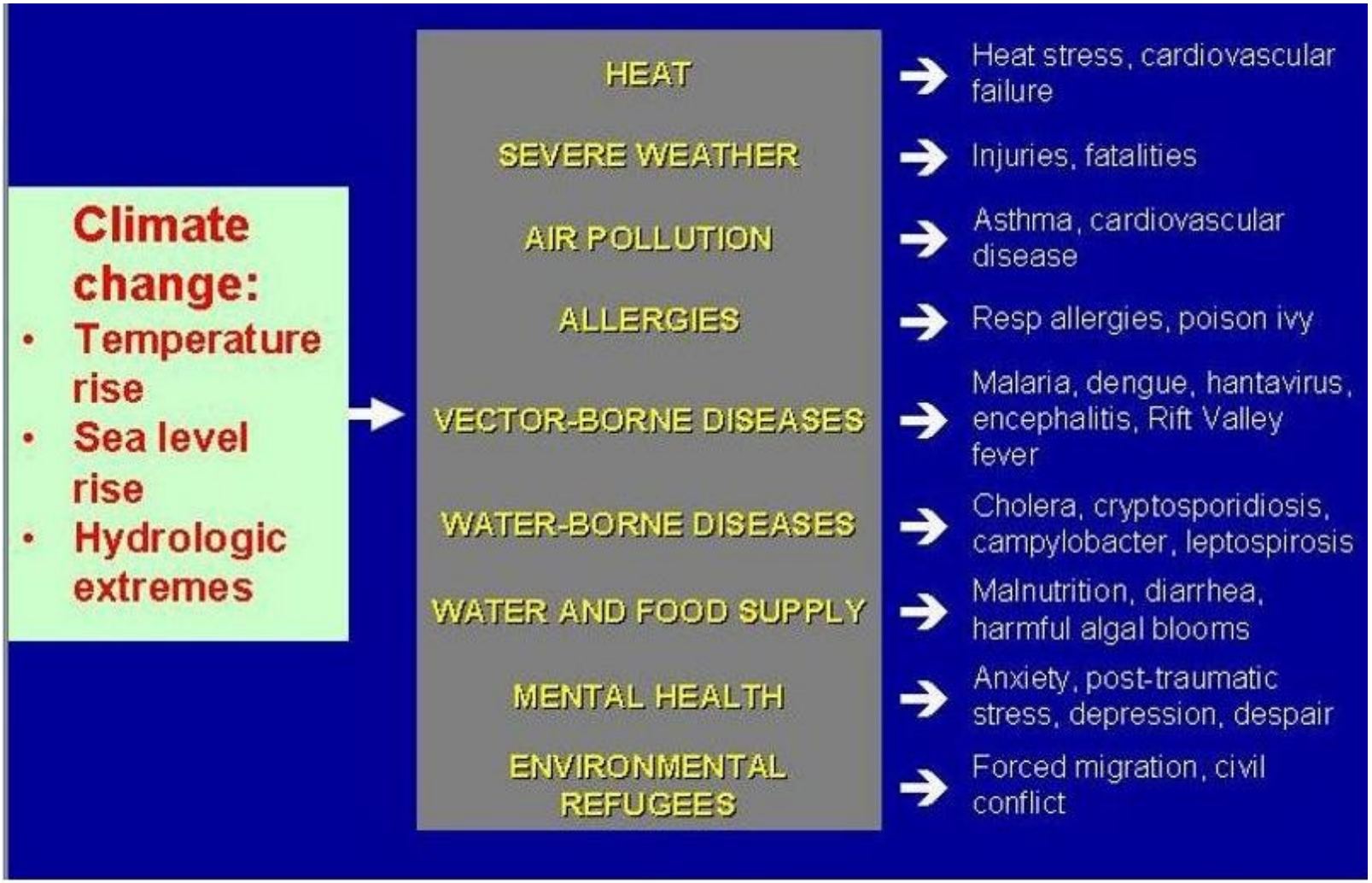
Potential Evapotraspiration



Salazar and Poveda (2007)

4. Socio-Environmental Vulnerability of the Andes/Amazon region and the impacts of climate change and land use-land cover change

Potential Effects of Climate Change on Human Health



Frumkin (2008)

Human Health Risks due to Climate Changes

Disease	Vector	Population at risk (million)[1]	Number of people currently infected or new cases per year	Present distribution	Likelihood of altered distribution
Malaria	Mosquito	2,400[2]	300-500 million	Tropics and Subtropics	Highly likely
Schistosomiasis	Water snail	600	200 million	Tropics and Subtropics	Very likely
Lymphatic Filariasis	Mosquito	1 094[3]	117 million	Tropics and Subtropics	Likely
African Trypanosomiasis (Sleeping sickness)	Tsetse fly	55[4]	250 000 to 300 000 cases per year	Tropical Africa	Likely
Dracunculiasis (Guinea worm)	Crustacean (Copepod)	100[5]	100 000 per year	South Asia, Arabian Peninsula, Central-West Africa	Unknown
Leishmaniasis	Phlebotomine sand fly	350	12 million infected, 500 000 new cases per year[6]	Asia, Southern Europe Africa, Americas	Likely
Onchocerciasis (River blindness)	Black fly	123	17.5 million	Africa, Latin America	Very likely
American Trypanosomiasis (Chagas disease)	Triatomine bug	100[7]	18 million	Central and South America	Likely
Dengue	Mosquito	1,800	10-30 million per year	All Tropical countries	Very likely
Yellow Fever	Mosquito	450	more than 5 000 cases per year	Tropical South America Africa	Likely

1. Top three entries are population-prorated projections, based on 1989 estimates.
2. WHO, 1994.
3. Michael and Bundy, 1995.
4. WHO, 1994.
5. Ranque, personal communication.
6. Annual incidence of visceral leishmaniasis; annual incidence of cutaneous leishmaniasis is 1-1.5 million cases/yr (PAHO, 1994).
7. WHO, 1995.

Highly likely · Very likely · Likely · Unknown

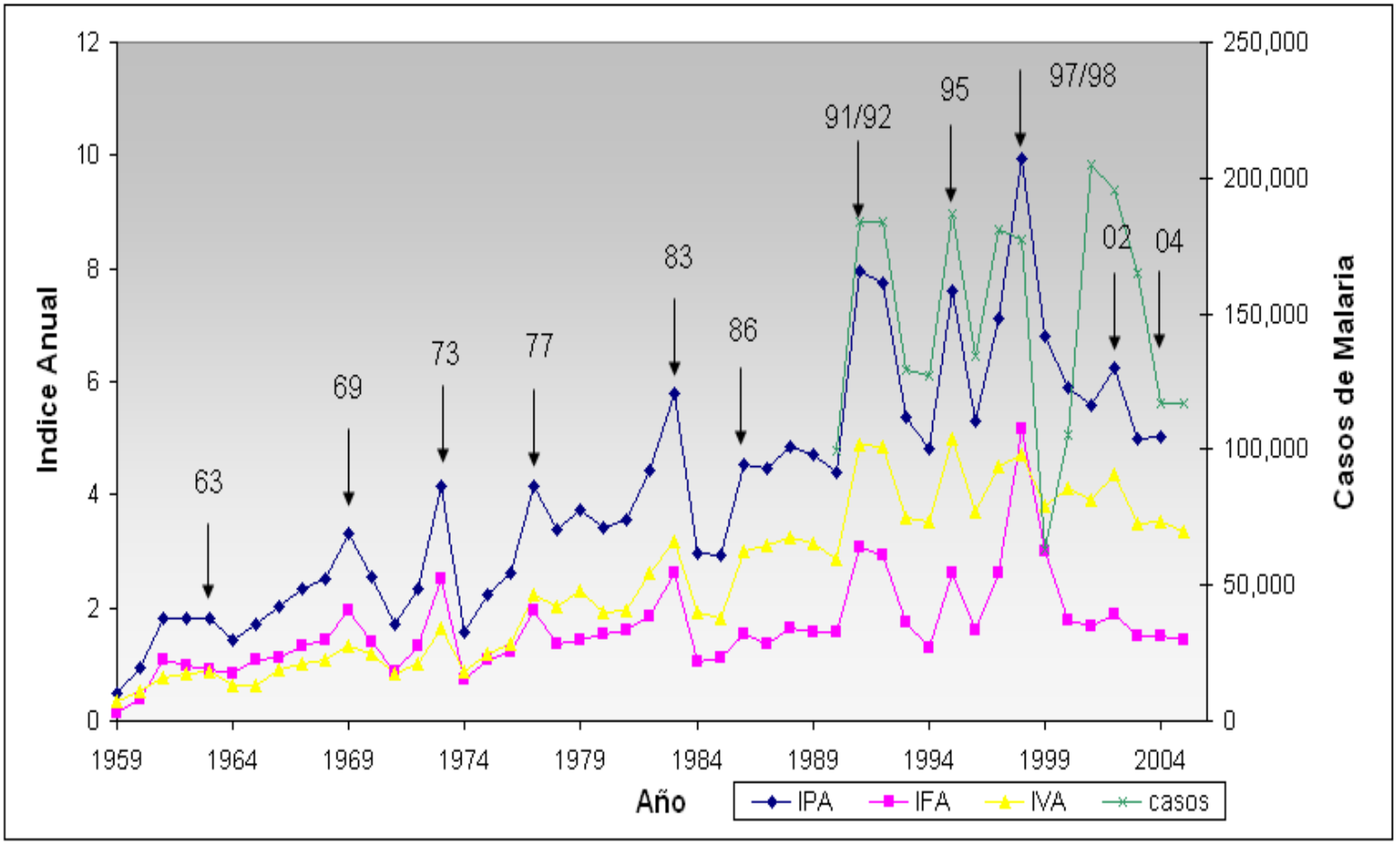
GRID Arendal UNEP

GRAPHIC DESIGN: PHILIPPE REKACEWICZ

Source: Climate change 1995, Impacts, adaptations and mitigation of climate change: scientific-technical analyses, contribution of working group 2 to the second assessment report of the intergovernmental panel on climate change, UNEP and WMO, Cambridge press university, 1996.

Frumkin (2008)

Malaria in Colombia
Climate Change? + El Niño



Poveda & Rojas (1995)
Poveda et al. (2000)
Estrada & Poveda (2007)

Tropical Andes:
The most critical hotspot for biodiversity on Earth

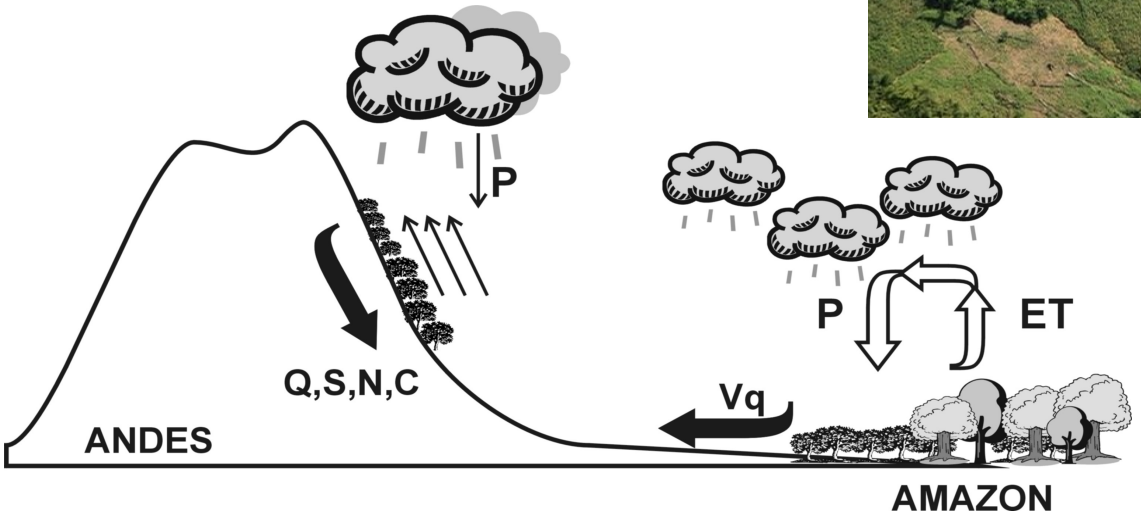
The 25 Biodiversity Hotspots

1. Tropical Andes
2. Mesoamerica
3. Caribbean
4. Atlantic Forest Region
5. Chocó-Darién-Western Ecuador
6. Brazilian Cerrado
7. Central Chile
8. California Floristic Province
9. Madagascar and Indian Ocean Islands
10. Eastern Arc Mts. & Coastal Forests
11. Guinean Forests of West Africa
12. Cape Floristic Province
13. Succulent Karoo
14. Mediterranean Basin
15. Caucasus
16. Sundaland
17. Wallacea
18. Philippines
19. Indo-Burma
20. Mountains of South-Central China
21. Western Ghats and Sri Lanka
22. Southwest Australia
23. New Caledonia
24. New Zealand
25. Polynesia/Micronesia

Source: Cincotta, 2000 (275)

Myers et al., *Nature*, 2000

Coca: actual problem, wrong solutions. Land use change and downstream water pollution



Summary

lWe propose to develop an RHP for the Andes-Amazon Region.

Change and Biodiversity in the Tropical Andes
http://www.iai.int/wp-content/uploads/2014/06/book.pdf
regional information system to support climate change and biodiversity public polices http://geoportal.ciifen.org/es/

CIIFEN (Guayaquil-Ecuador)

Hydro-meteorological and Vulnerability Atlas for the Amazon Region, developed by CIIFEN (funded by OTCA which is the Amazonia Cooperation Treaty Organization which involves 9 South American countries. The final version is on review and will be posted online in October 2016.

As CIIFEN we are very interested to contribute in the vulnerability integrated assessment component and of course to help in the regional coordination and exploration of funding opportunities.

potential initiative.
To provide our facilities and coffee breaks for a meeting (up to 30 persons) in the date we agree.
To contribute in contacting and inviting potential funding agencies.

At this time we have schedule workshops, meetings, missions until December 9th 2016, but we have the week 12-16 December 2016 available to organize a two or three days workshop. But of course we can plan it for next year, but this should be done in advance since there are several global and regional meetings coming up in the first half of 2017.

Who will be the pushers/pullers?

Is there a need to add the “Food baskets GC” idea here as well?

Practical 1st „Steps

Seems to generate interest globally

Report back next SSG with first outline of next steps (and maybe draft first plan)