

Advances, risks, and perspectives of water management in Bolivia



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IRD
Institut de recherche
pour le développement



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Agenda for Bolivia

1. Characteristics, potential and problems of water
2. Historical context of water management
3. State of water services and problems to solve
4. National plans
5. Bolivia's new paradigm for water management
6. National Basic Services Plan
7. Climate Change into consideration
8. UN recognition

1 - Characteristics, potential and problems of water

Bolivia in numbers

Area	1,098,581 km ²
Population	<p>9.6 millions (2006)</p> <p>64.2% urban, 35.8% rural</p> <p>7.2 person / km²</p> <p>32.3% agriculture, 21.6% industry, 46.0% services</p> <p>Mean per capita income: USD 950 / year</p> <p>Growth: 2.0% mean, 3.6% urban, 1.4% rural</p>
Population access	<p>Drinking water: 95% urban, 68% rural</p> <p>Sanitation: 60% urban, 22% rural</p>
Water	<p>Availability: 69,271 m³/pers./year</p> <p>Total extraction: 1,387 10⁶ m³</p> <p>83% agriculture, 13% domestic, 3% industry</p> <p>Total consumption of renewable water: 0.2%</p> <p>Extraction: 167 m³/pers./year</p> <p>Irrigated area: 132,000 ha, 4.2% area</p>

Schematic 3D map of Bolivia



**Endorreic
Altiplano:**
13 % area

Amazonas:
66% area
95% water

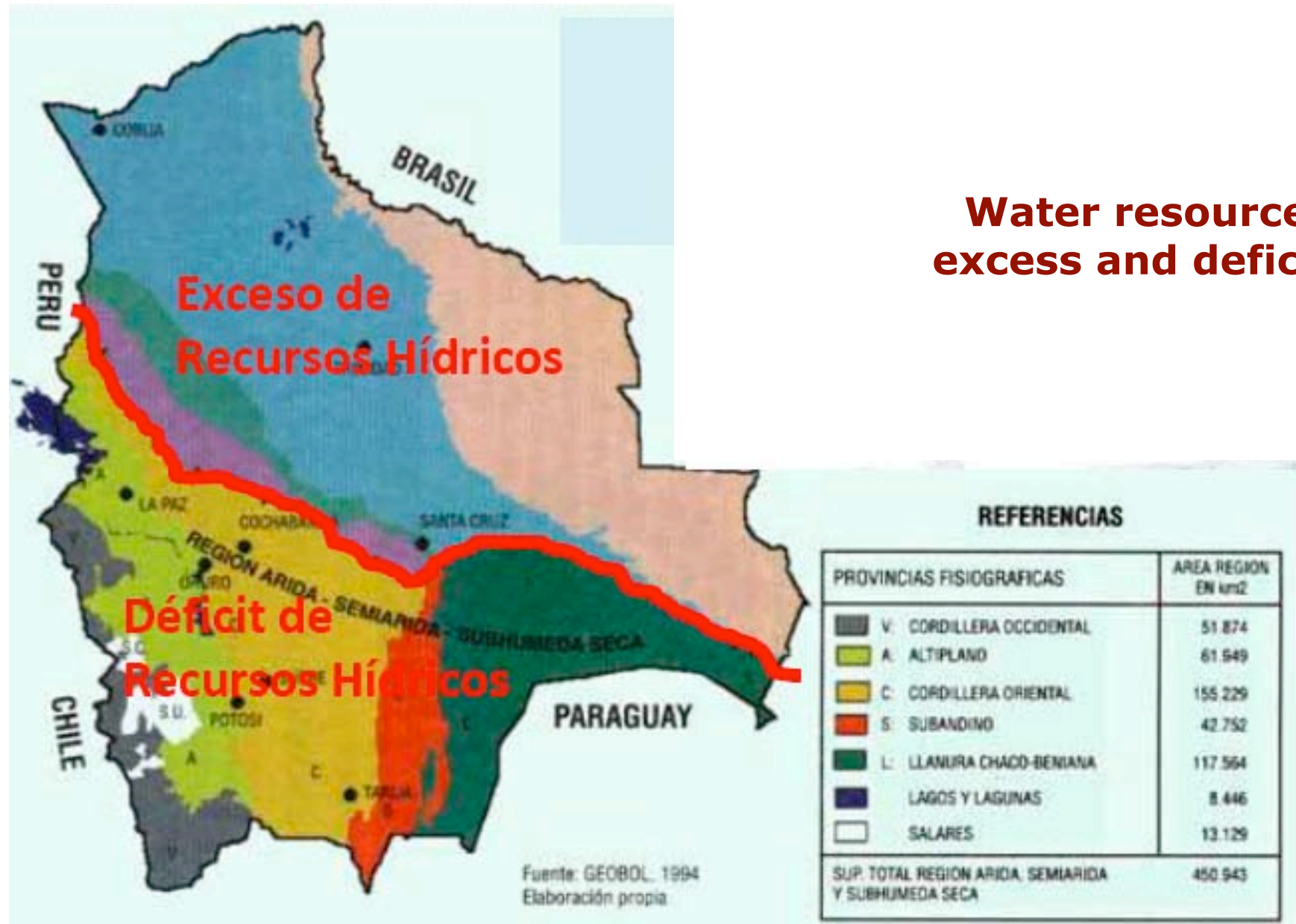
Plata:
21% area

3 hydrographic basins

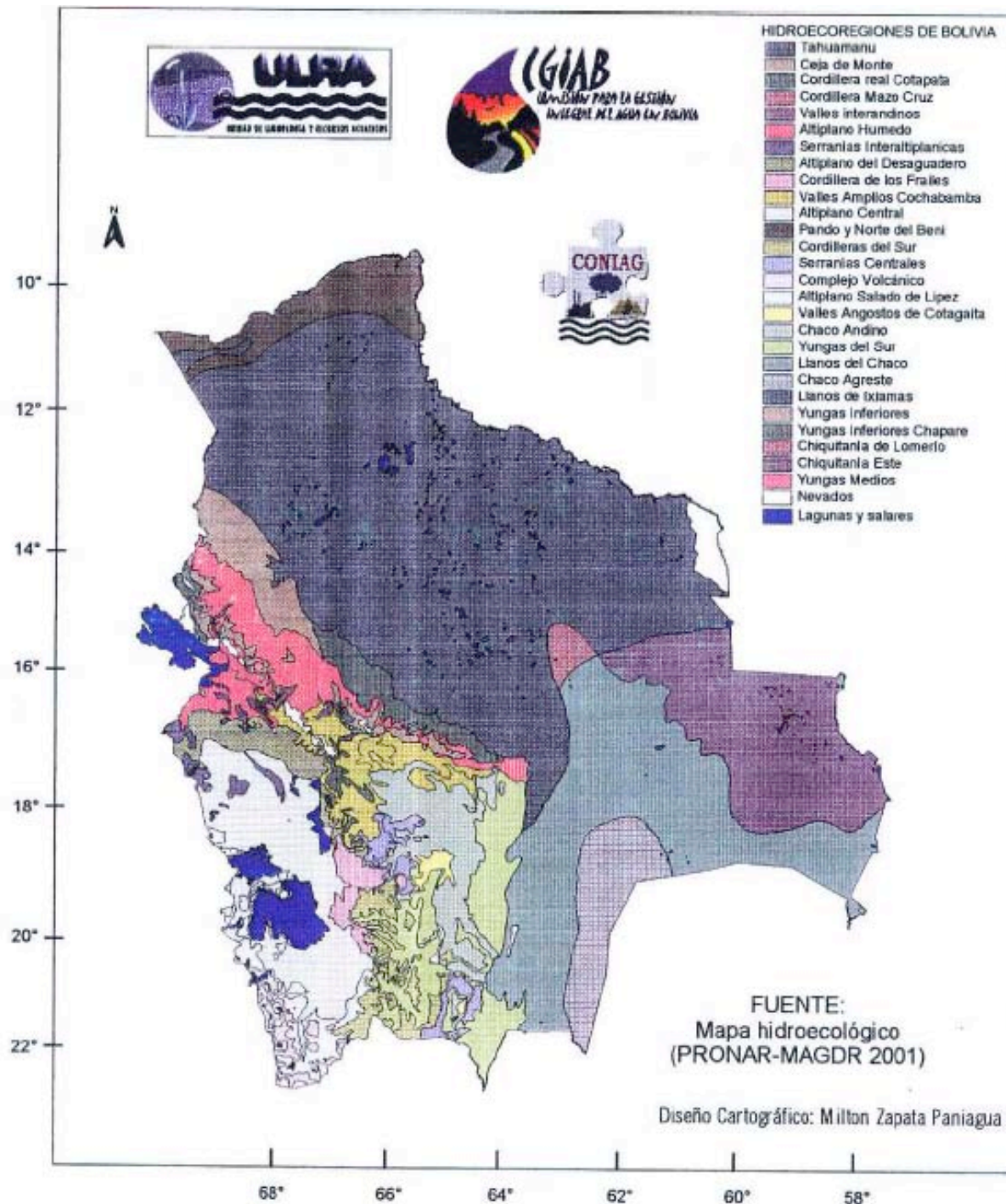


Source:
Ministerio del Agua en Bolivia (2008)
El agua en Bolivia

Water resources excess and deficit



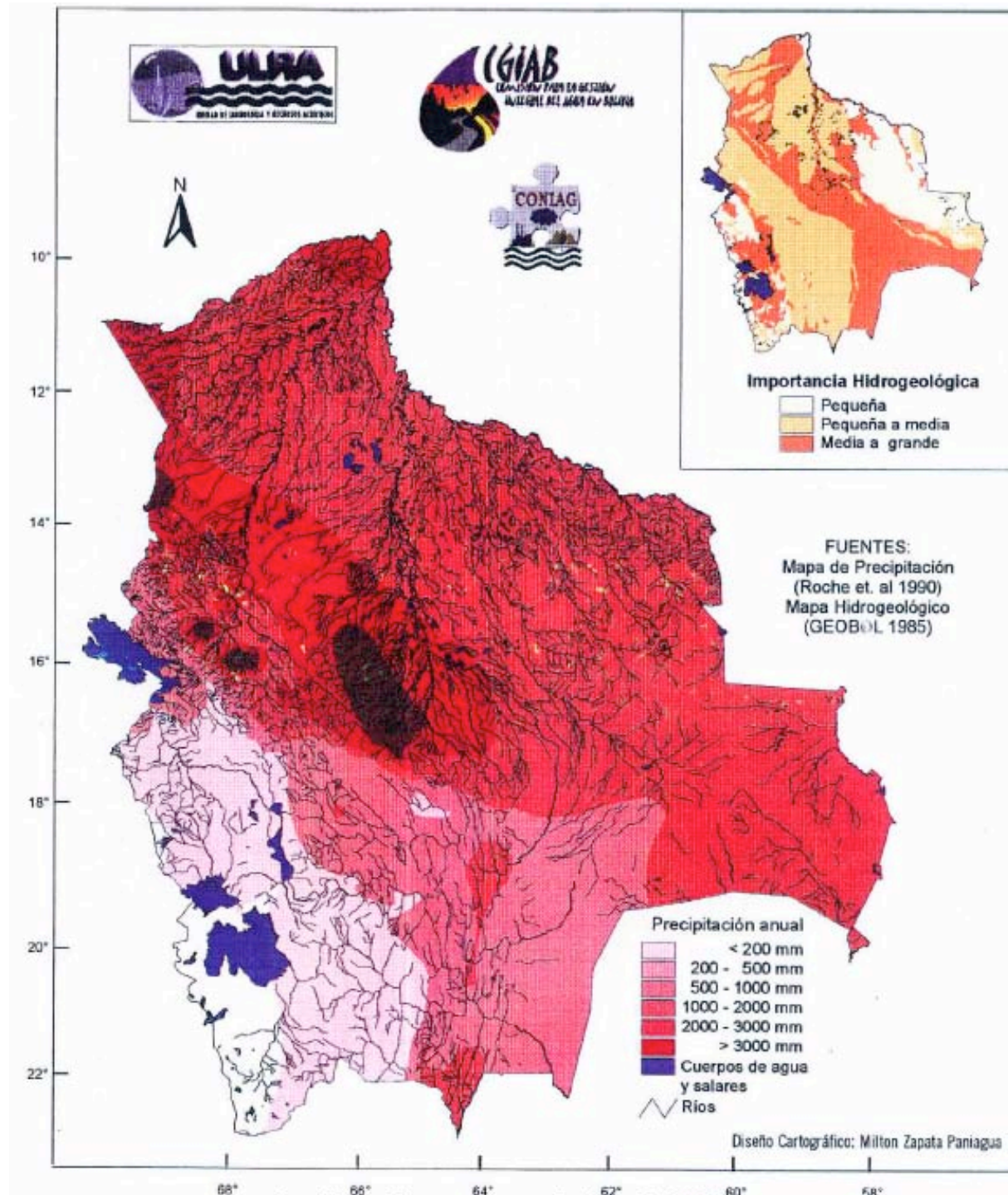
Source: J.L. Gutiérrez Ossio, Ministerio de Medioambiente y Agua, Ministerio de Planificación del Desarrollo



Hydroecological map

- Ecological map
- Basin, sub-basin, micro-basin map
 - Poverty level
 - Degradation of renewable natural resources

⇒ **Level of priority intervention**



Annual precipitation (mm/yr)

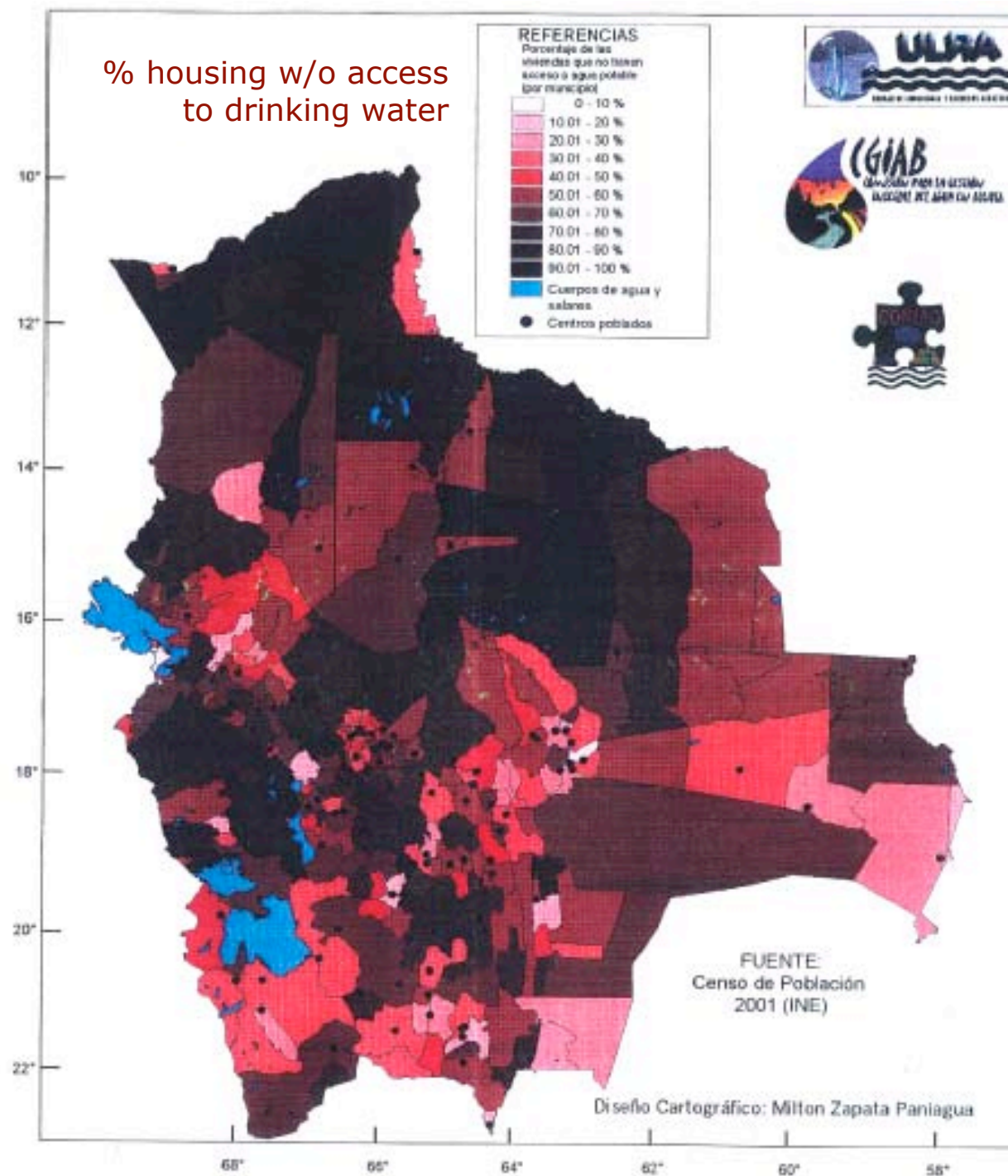
- South-West < 100 mm
- Altiplano 100-300 mm
 - Oriente 1700 mm
 - Pando 2200 mm
- Chapare > 5000 mm

Irrigation systems per Department

(MAGDR-DGSR-PRONAR 2000)

Departamento	Sistemas		Usuarios		Area regada	
	Número	%	Familias	%	Hectáreas	%
Chuquisaca	678	14.5	17 718	8.1	21 168	9.4
Cochabamba	1 035	21.9	81 925	37.6	87 534	38.6
La Paz	961	20.3	54 618	25.1	35 993	15.9
Oruro	312	6.6	9 934	4.6	14 039	6.2
Potosí	956	20.2	31 940	14.7	16 240	7.2
Santa Cruz	232	4.9	5 865	2.6	15 239	6.7
Tarija	550	11.6	15 975	7.3	36 351	16.0
Total	4 724	100.0	217 975	100.0	226 564	100.0

Departamento	Ríos		Vertientes		Pozos		Embalses		Total
	Sistemas (N°)	Área (ha)	Sistemas (N°)	Área (ha)	Sistemas (N°)	Área (ha)	Sistemas (N°)	Área (ha)	Área (ha)
Chuquisaca	615	18 059	28	587			5	2 522	21 168
Cochabamba	415	48 979	95	3 310	469	13 442	56	21 270	87 001
La Paz	661	23 271	258	4 166	13	163	29	8 393	35 993
Oruro	224	8 513	84	722	4	107	5	4 697	14 039
Potosí	735	10 840	208	4 829	9	68	4	503	16 240
Santa Cruz	225	11 099	3	25	1	380	3	3 735	15 239
Tarija	523	33 771	26	230			1	2 350	36 351
Totales	3 428	154 582	702	13 869	496	14 160	103	43 470	226 031



Drinking water availability per Municipio

(Census 2001)

*Availability:
urban > rural*

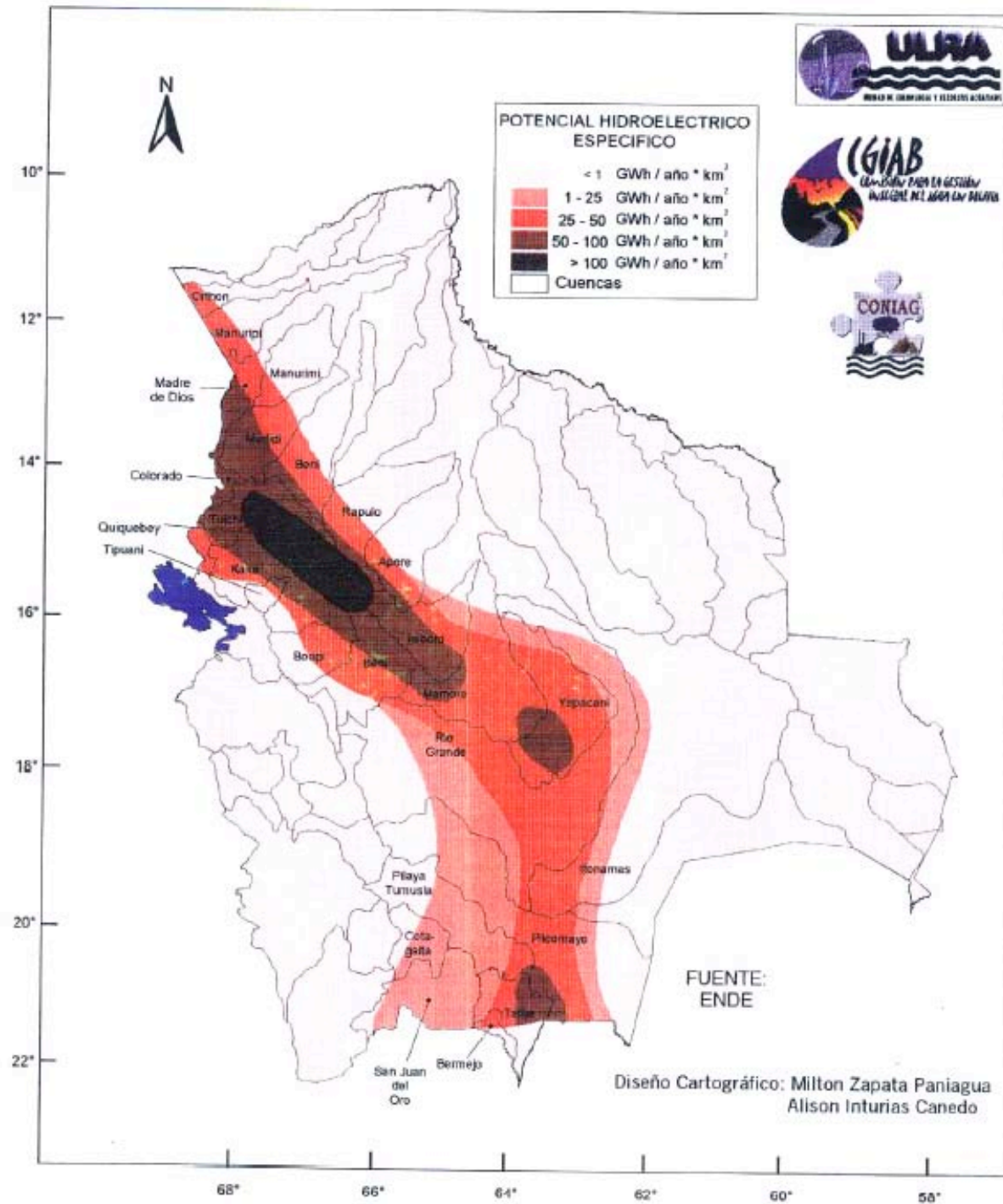
*In urban areas
domestic consumption prevails*

*Only 5 of 9 major capital cities
with 24h service!*

*Major problems
of water supply:
Cochabamba > Potosí,
Sucre, Cobija*

*The current
main energetic source
in Bolivia*

*Yet its potential
has not been explored*













Contamination sources of superficial waters

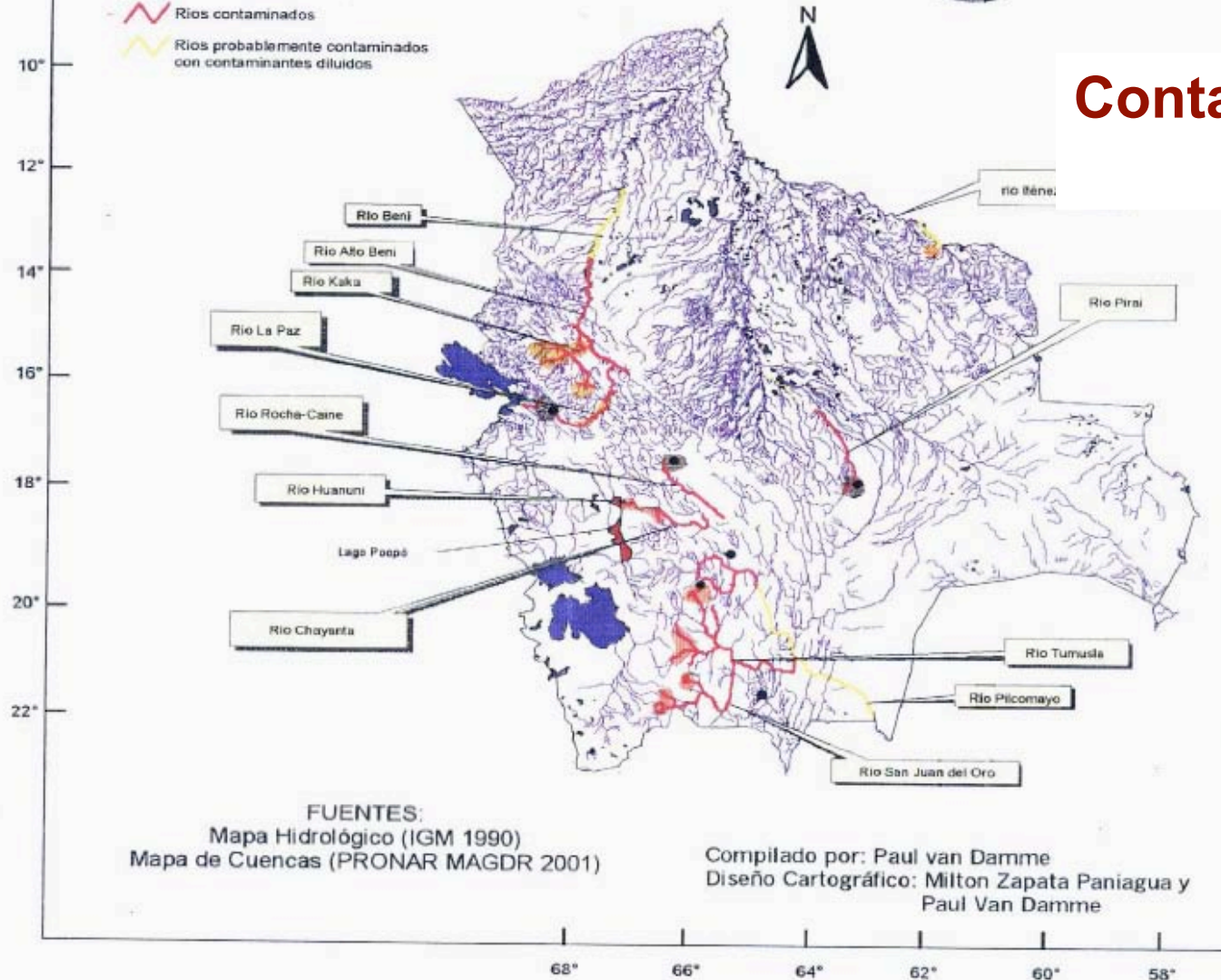
- Historically, mining is THE FIRST major problem of water contamination in Bolivia
- 3 major watersheds severely contaminated: Pilcomayo (Pb of Potosi mines), Amazonas (Hg of gold mines), Endorreic (natural Pb, As)
- Acid Rock Drainage of SO_4 , Zn, Cd, Cu, Pb, As, Sb

No other contamination is so important

- Organic from domestic liquid wastes: *urban waste waters, sewage systems, water treatment systems*
- Industrial: *more pollutant are textile, instant foods, soft drinks, paper pulp, beer, slaughterhouse*
- Pesticides, fertilizers, fossil fuels, consequences of soil uses

Contaminación de aguas superficiales

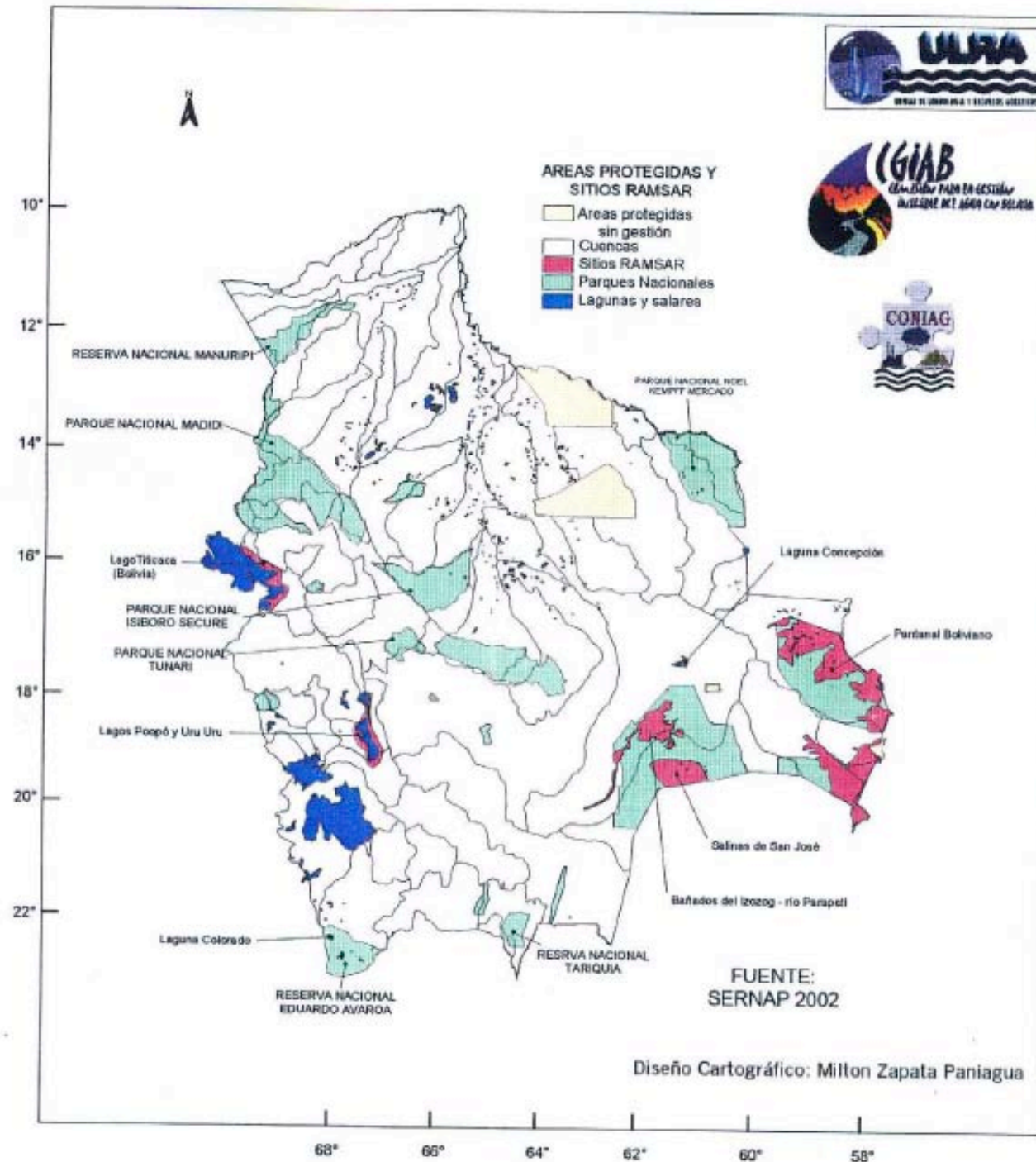
-  Zonas de actividades mineras auríferas
-  Zonas de contaminación doméstica e industrial (La Paz, El Alto, Cochabamba, Santa Cruz)
-  Zonas de actividades mineras no - auríferas
-  Cuerpos de agua y salares no contaminados y/o no - estudiados
-  Cuerpos de agua contaminados con metales pesados
-  Ríos no contaminados y/o no estudiados
-  Ríos contaminados
-  Ríos probablemente contaminados con contaminantes diluidos



FUENTES:
Mapa Hidrológico (IGM 1990)
Mapa de Cuencas (PRONAR MAGDR 2001)

Compilado por: Paul van Damme
Diseño Cartográfico: Milton Zapata Paniagua y
Paul Van Damme

**Contamination map of
superficial water**



Protection and management of water resources

National system of protected areas (SERNAP)

17 parks
16% Bolivia area

Soil use planes (PLUS)

- "Tierras de protección con uso limitado"
- "Areas Protegidas"

Wetlands and RAMSAR sites

260 wetlands
Pantanal, Laguna Colorada, lakes Poopó, Uru Uru, Titicaca

Cities indirectly depending on protected areas to supply drinking or irrigation water

Cities	Protected área
La Paz	Parque Nacional Tuni Condoriri Reserva Municipal Huaripampa
Potosi	Lagunas de Kankari Rio San Juan
Cochabamba	Parque Nacional Tunari
Santa Cruz	Parque Nacional Amboró
Bermejo	Reserva Nacional de Flora y Fauna Tariquia
Yacuba, Villamontes, Carapari	Parque Nacional Aguaragüe
Tarija	Reserva Biológica Cordillera de Sama



2 - Historical context of water management in Bolivia

3 HISTORICAL MANAGEMENT PERIODS

1 - Monopoly and privatization stage (pre-Water War)

Various privatization of services and concessions: e.g. water concession export to Chile through a 2000 bill passed by the Deputy chamber w/out consultation - 3-yr conflict

2 - Stage of re-appropriation of water in Bolivia (Water War)

2000 - 'Guerra del Agua' in Cochabamba - video on YouTube

http://www.youtube.com/watch?v=uQ12LB_6STc

3 - Process of change in the water management Bolivia's new paradigm and for the rest of the World! (post-Water War)

New management w/ recovery of management by the State, new State Political Constitution w/ water as a Human Right and approval by the UN



2000 - 'Guerra del Agua' in Cochabamba - video on YouTube
http://www.youtube.com/watch?v=uQ12LB_6STc

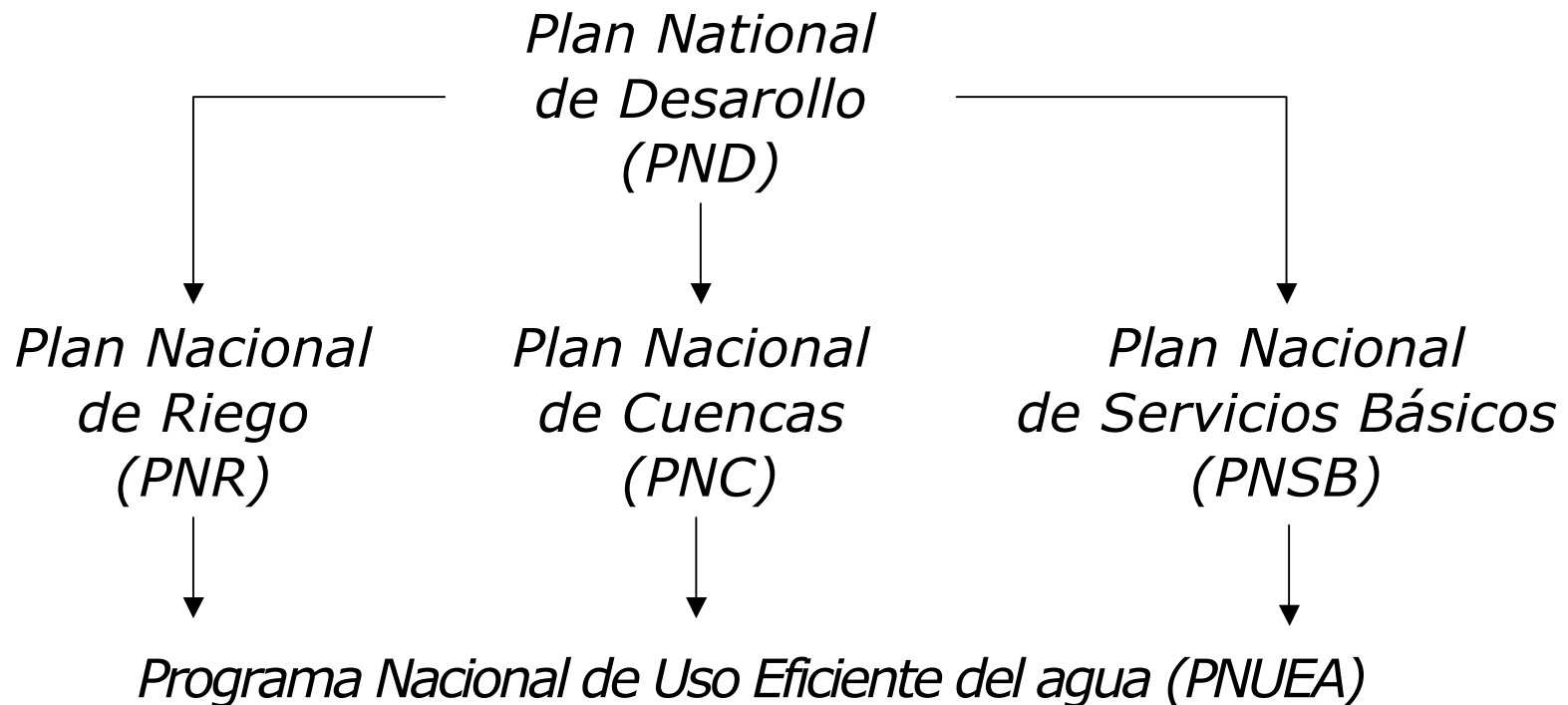
3 - State of water services and problems to solve

State of water services and main problems

DEFICIT AND INEQUITIES

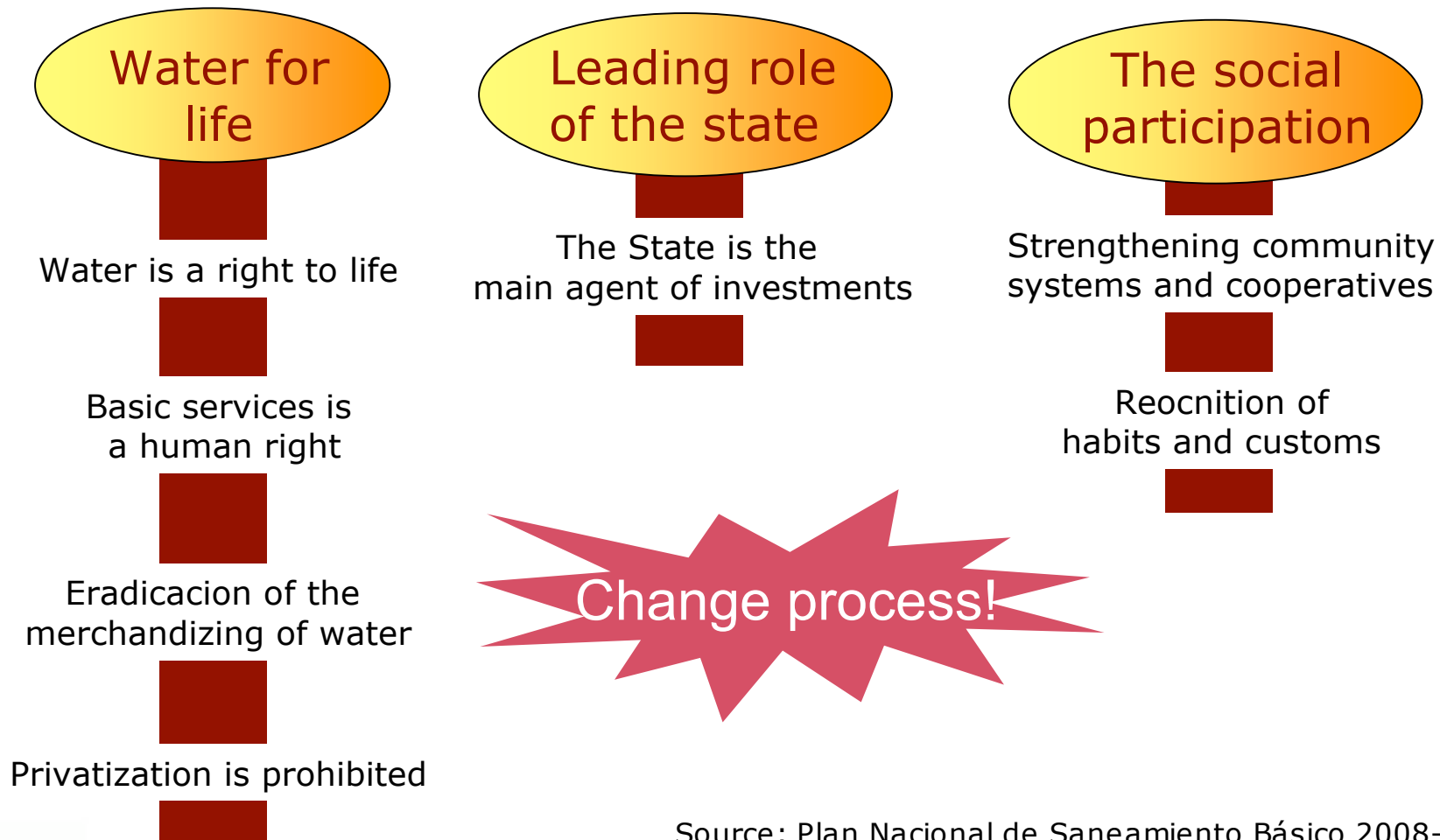
- The sanitation sector illustrates the **inequalities** and **discrimination** that characterize Bolivia: the poor, the indigenous and the farmers have less access to water and sanitation
- **Over 2.5 million people** lack access to potable water and **more than 5.3 million** lack sanitation

4 - National Plans are the State active responses !



5 - BOLIVIA's NEW PARADIGM OF WATER MANAGEMENT

3 BASIC PILLARS FOR THE NATIONAL PLANS



BASIC PRINCIPLES OF THE NATIONAL DEVELOPMENT PLAN (PND)

- Water is a human right and public resource. State plays a key role for allocating, monitoring and promoting use/management
- Public services are a priority over private. Rates should not allow utilities to profit.
- Water = natural resource, finite, vulnerable, serving social, environmental and economic functions
- State recognizes ancestral use by indigenous communities, respects and protects its water rights, natural authorities and their customs
- Use/exploitation of water resources integrated, priority to human consumption, agricultural production and the needs of flora and fauna
- Basic unit of planning/management = watershed
- Management harmonizes current needs with future generations
- Public policies incorporate civil society, rural communities, indigenous peoples, with effective participation of women, social organizations
- **New vision** of a dignified Bolivia, sovereign and democratic within the “**vivir bien**” context, i.e. recover a respectful and friendly relationship to nature and the society

6 - National Basic Services Plan (PNSB) 2008-2015

PRINCIPLES OF THE PNSB

- Access to water and sanitation is a fundamental Human Right
- Water and sanitation are not subject to concession or privatization
- The State is responsible of providing basic services through direct provision, or government enterprises, cooperatives, community or mixed
- Social and gender equity
- The State recognizes the social and ancestral use of peasant and indigenous communities from the country, respecting their "uses and customs"
- It is the State and people duty to conserve, protect and exploit water resources in a sustainable way

PNSB COVERAGE GOALS FOR 2008 - 2015

		Current coverage		Increase in population with access 2007-2015		NEW!
	Population	Water	Sanitation	Water	Sanitation	wastewater treatment
	x10 ⁶ inhab.	%	%	x10 ⁶ inhab.	x10 ⁶ inhab.	x10 ⁶ inhab.
Urban	7.7	95	79	1.7	2.7	2.6
Rural	3.7	80	80	1.2	1.7	0
National	11.4	90	80	2.9	4.4	2.6

Identifying areas of investment in basic sanitation

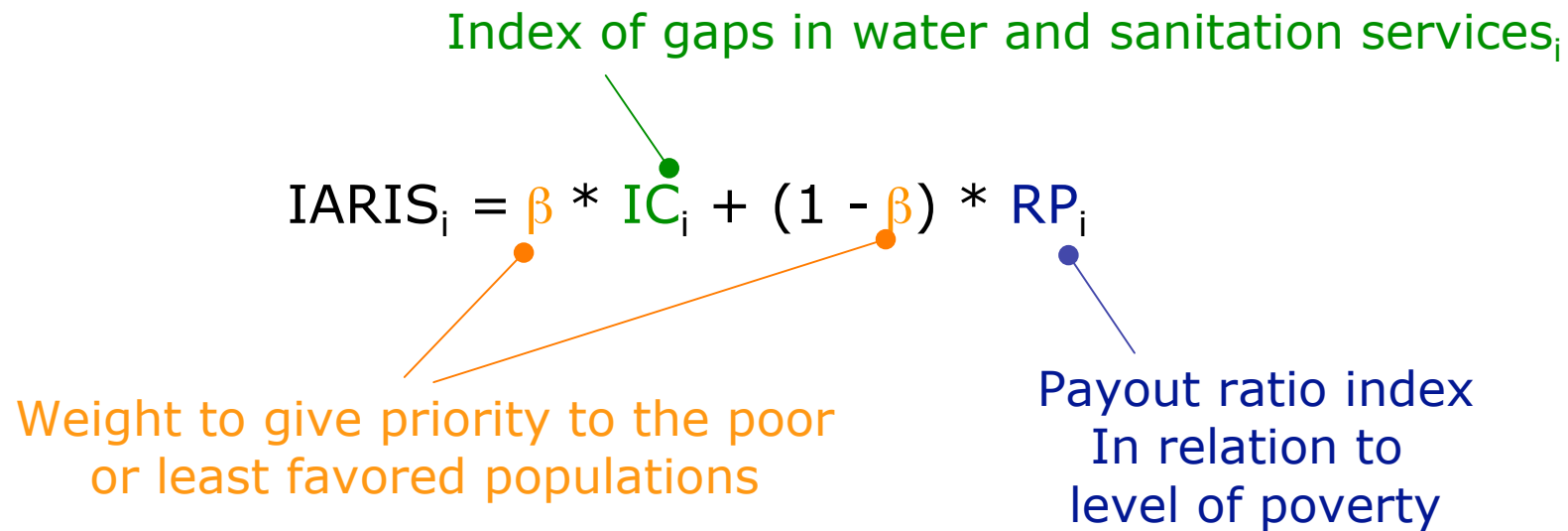
IARIS = Identificador de Áreas de Inversión en Saneamiento básico

Index of gaps in water and sanitation services_i

$$\text{IARIS}_i = \beta * \text{IC}_i + (1 - \beta) * \text{RP}_i$$

Weight to give priority to the poor or least favored populations

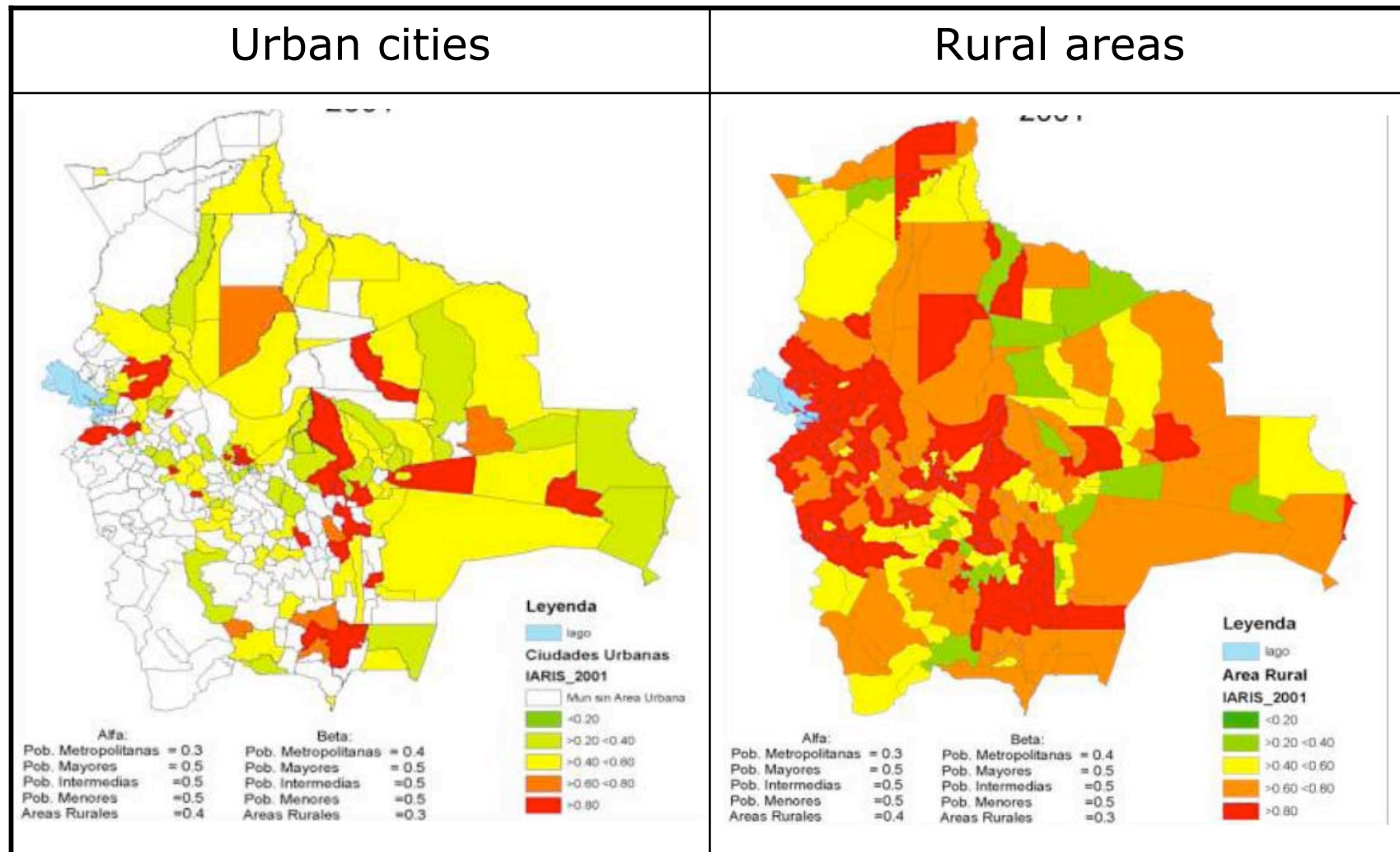
Payout ratio index
In relation to
level of poverty

The diagram illustrates the formula for IARIS. It features the equation $\text{IARIS}_i = \beta * \text{IC}_i + (1 - \beta) * \text{RP}_i$. A green dot is placed above the IC_i term, with a green arrow pointing to the text 'Index of gaps in water and sanitation services_i'. An orange dot is placed below the β term, with an orange arrow pointing to the text 'Weight to give priority to the poor or least favored populations'. Another orange dot is placed below the $(1 - \beta)$ term, with an orange arrow pointing to the same text. A blue dot is placed below the RP_i term, with a blue arrow pointing to the text 'Payout ratio index In relation to level of poverty'.

... this criteria computed by “municipio”

... focus on **Complejos Productivos Territoriales (CPT)**

IARIS maps 2001



PNSB 2008-2015

Required investment for CPT until 2015

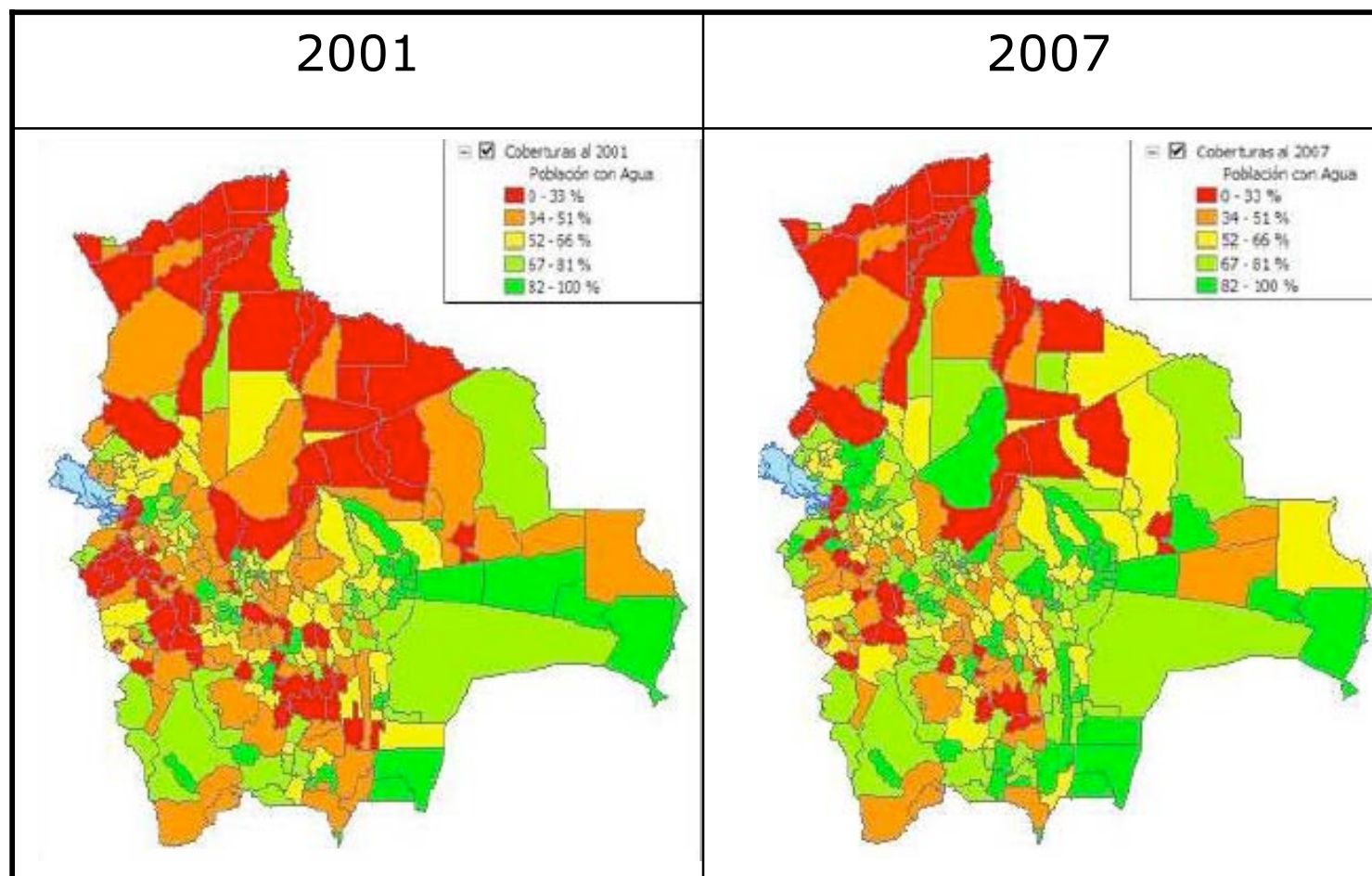
Departments	CPT (Complejos Productivos Territoriales)	2007-2015 increase of served population x 10 ³		2007-2015 investments (USD x 10 ⁶)	
		Water	Sanitation	Water	Sanitation
La Paz	Titicaca, Yungas	62.3	98.1	4.6	7.4
Oruro	Sajama	5.1	3.1	0.3	0.2
Potosi	Tupiza, Cotagaita...	2.0	6.4	0.1	0.5
Santa Cruz	El Torro, Warnes, Chaco, San Mátiás...	50.3	65.0	3.5	7.1
Chuquisaca	Chaco, Cinti	37.2	50.6	2.5	3.6
Cochabamba	Chapare, Vale Alto, Vale Bajo	63.3	68.0	4.7	5.4
Tarija	Bermejo, Chaco	2.0	10.4	0.1	0.7

90% coverage in water access and sanitation for the indigenous peoples

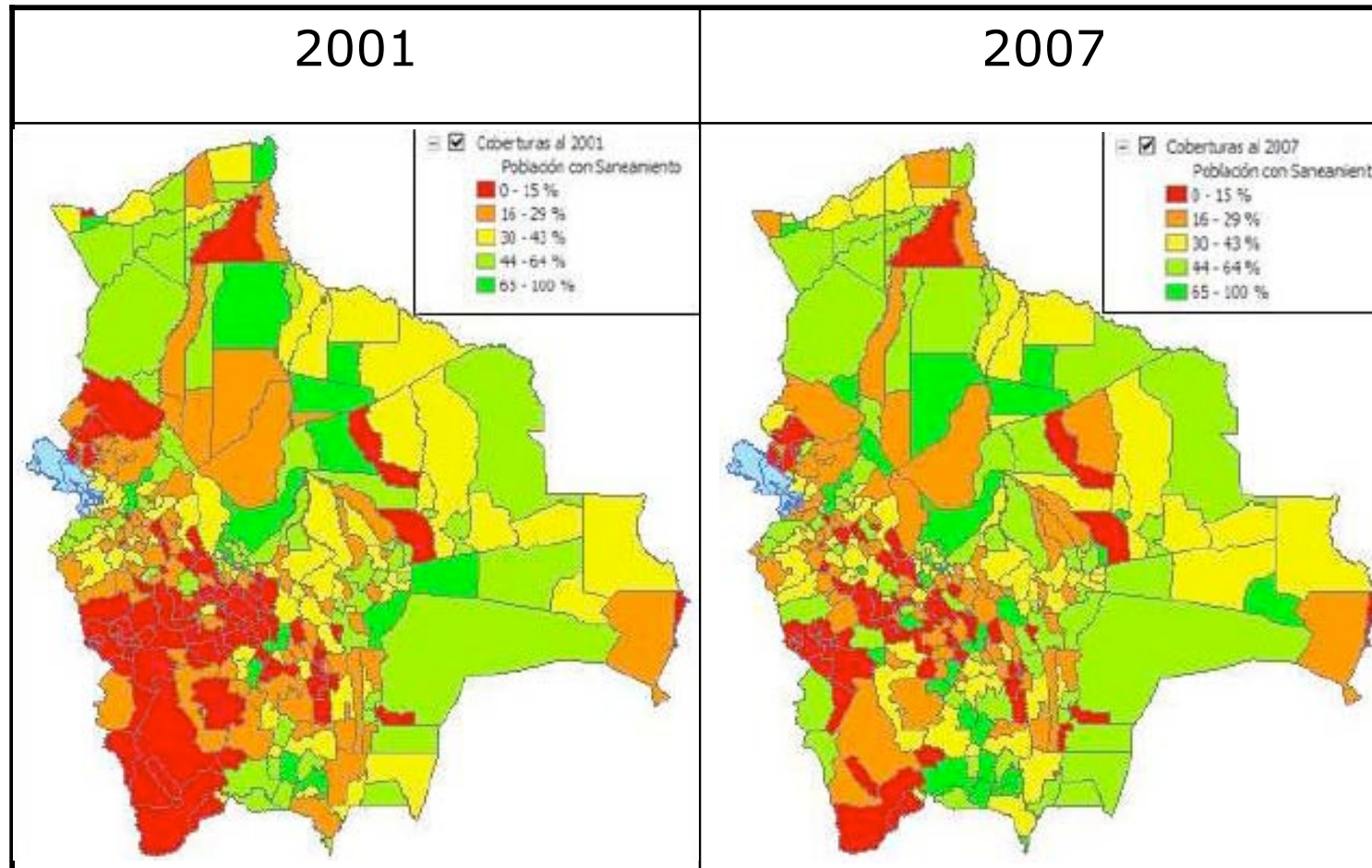
Attention to indigenous peoples is a priority for the Government and is set in the National Development Plan

Indigenous peoples	2007-2015 increase of served population x 10 ³		2007-2015 investments (USD x 10 ⁶)	
	Water	Sanitation	Water	Sanitation
28 in Amazonas, 2 in Chasqueña				
90% coverage	80.1	87.4	5.2	6.3

Coverage in drinking water



Coverage in sanitation



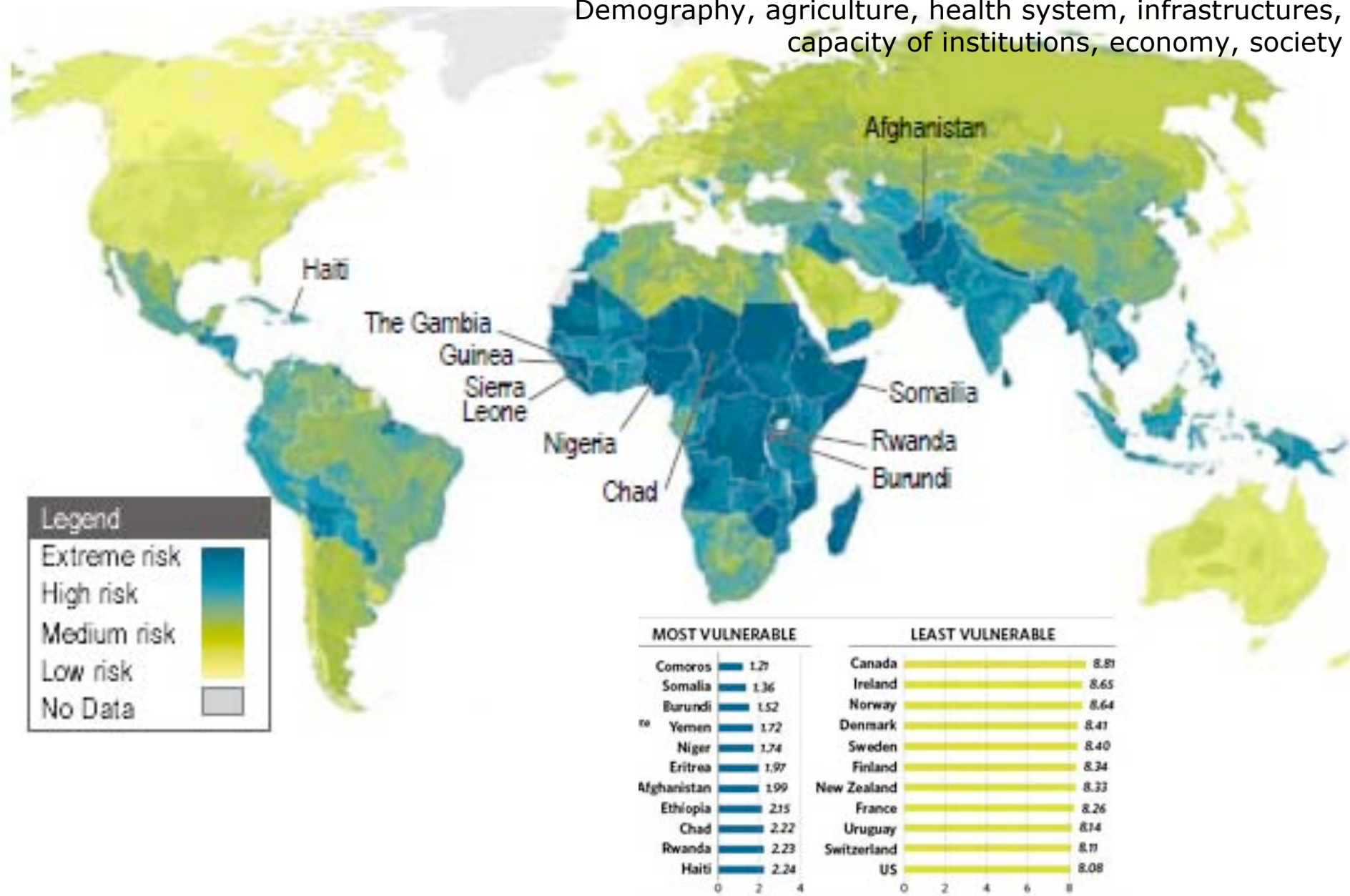
7 - CLIMATE CHANGE AS RISK FOR ACCESS AND USE OF WATER



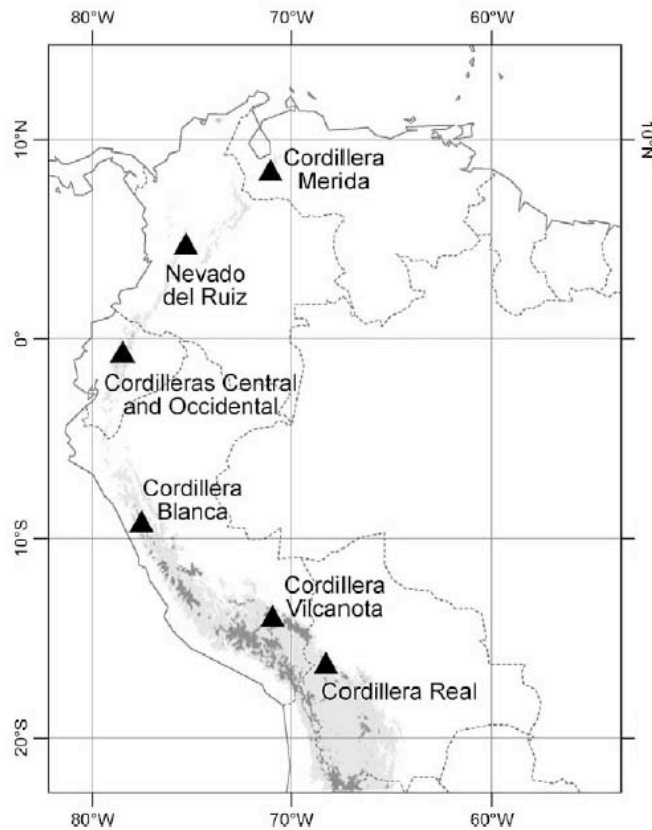
World vulnerability index to climate change

42 indicators:

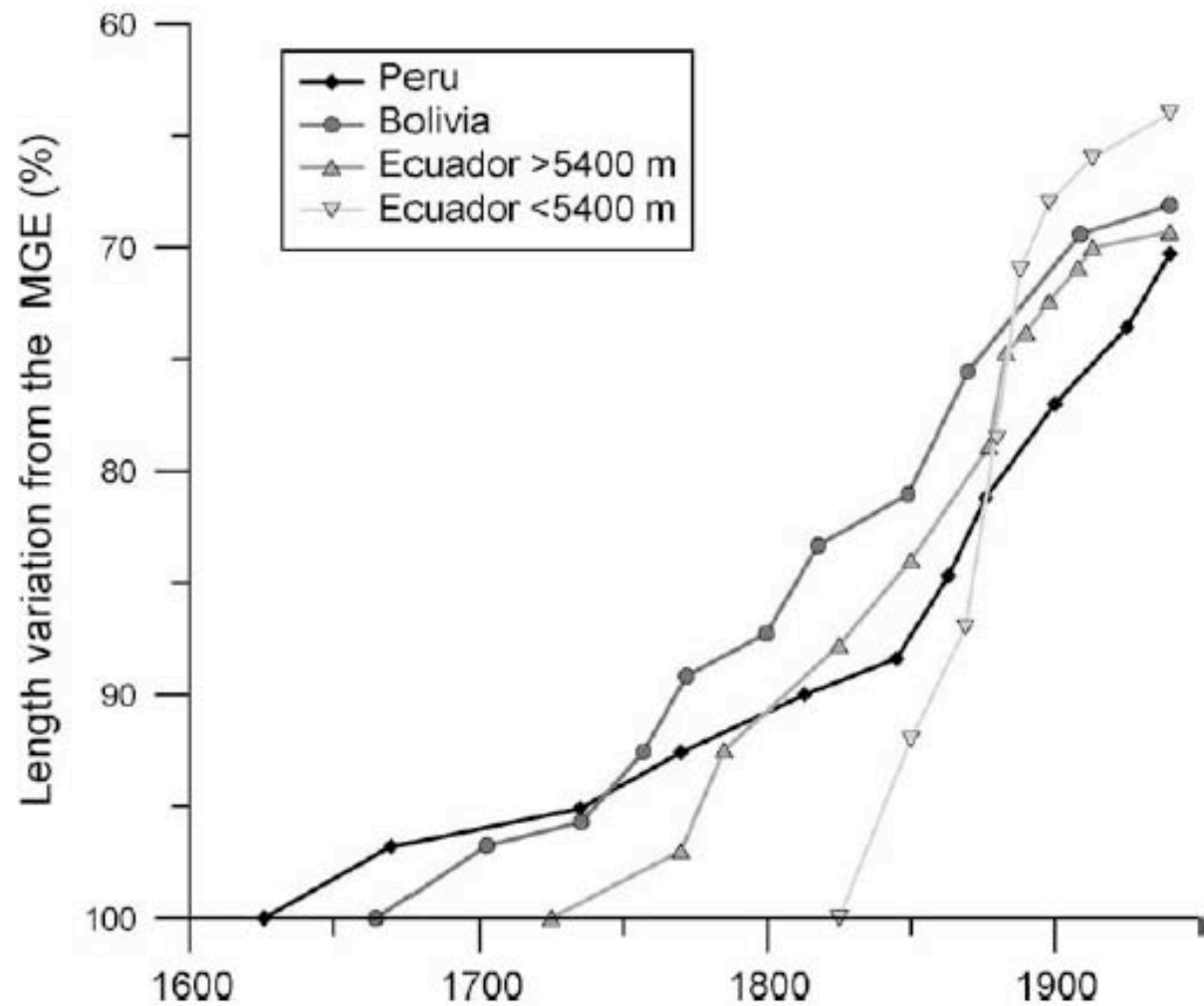
Demography, agriculture, health system, infrastructures,
capacity of institutions, economy, society



Retreat of tropical glaciers



*MGE = maximum
glacial extent*



Source: Jomelli et al. (2009)

Retreat of the Chacaltaya glacier, Bolivia, 1940–2005



Source: IPCC Working Group II Fourth Assessment Report 2007

Climate change considered in the National Program for Efficient Use of Water (PNUEA)

- Contribution of Bolivia to CC is small, so reducing Bolivia's contribution to carbon emissions will have little benefits
- Bolivia's contribution to mitigation comes from its active participation in international conferences where reduction measures for industrialized countries are defined
- For water and sanitation sectors, the only option is adaptation
- Basic measures to avoid wasting water
- BID Peri-urban program includes a CC chapter!

National Program for Efficient Use of Water (PNUEA)

1. Reducing water loss in catchment systems, storage and distribution of drinking water
2. Implementing sewage treatment plants (PTAR) with focus on reusing water
3. Universalizing the use of water-saving equipments, particularly low-consumption toilets
4. Education and training on the efficient use of water
5. Elaborating new norms to limit artificial outflows
6. Implementing new fare policies promoting the efficient water use and discourage waste



UN Resolution 2010

United Nations

A/64/L.63/Rev.1*



General Assembly

Distr.: Limited
26 July 2010

Original: English

Sixty-fourth session

Agenda item 48

**Integrated and coordinated implementation of and follow-up
to the outcomes of the major United Nations conferences and
summits in the economic, social and related fields**

The human right to water and sanitation



1. *Declares* the right to safe and clean drinking water and sanitation as a human right that is essential for the full enjoyment of life and all human rights;



OP2 Calls upon states and international organizations to provide financial resources, capacity building and technology transfer, through international assistance and co-operation, in particular to developing countries, in order to scale up efforts to provide safe, clean, accessible and affordable drinking water and sanitation for all;

Resolución 2010 de las NNUU

(Spanish versión)

Naciones Unidas

A/64/L.63/Rev.1*



Asamblea General

Resolución 2010 de las NNUU

(Spanish version)

Distr. limitada
26 de julio de 2010
Español
Original en inglés

Sexagésimo cuarto período de sesiones
Tema 48 del programa
Aplicación y seguimiento integrados y coordinados
de los resultados de las grandes conferencias y
cumbres de las Naciones Unidas en las esferas
económica y social y esferas conexas

El derecho humano al agua y el saneamiento



1. *Declara* el derecho al agua potable y el saneamiento como un derecho humano esencial para el pleno disfrute de la vida y de todos los derechos humanos;



OP2 Llama a los Estados y Organizaciones internacionales a proveer recursos financieros, construcción de capacidades y transferencia tecnológica, a través de asistencia y cooperación internacional, en particular a los países en desarrollo, para poder aumentar los esfuerzos para suministrar agua potable, segura y saneamiento para todos,

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Thanks for your attention



***Dedicado a todos los que lucharon
para un Mundo mas equitable...***

