

MINISTRY OF SUSTAINABLE DEVELOPMENT AND PLANNING

Vice Ministry of the Environment,
Natural Resources and Forestry Development

NATIONAL CLIMATE CHANGE PROGRAM



GENERAL BASES FOR THE
APPLICATION OF THE
BOLIVIAN NATIONAL
IMPLEMENTATION
STRATEGY OF THE UNITED
NATIONS FRAMEWORK
CONVENTION ON CLIMATE
CHANGE



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1. EXECUTIVE SUMMARY

Climate change and its variability may affect human activity in different ways, particularly in a developing country such as Bolivia where fragile ecosystems combined with a vulnerable economy conspire to put human sustenance at risk.

Bolivia signed and ratified the United Nations Framework Convention on Climate Change (UNFCCC) and has been implementing the agreements since 1995. Bolivia has also signed and ratified the Kyoto Protocol and developed the institutional framework for the implementation of a flexible mechanism to attract investment in the forestry and energy sectors to which it contributes by fulfilling sustainable development objectives.

Climate change adaptation related to the implementation of articles 4.8 and 4.9 of the UNFCCC has received little support within the formal context of the UNFCCC meaning less performance from the countries. In spite of the formal limitations, Bolivia has established multilateral and bilateral initiatives and begun the adaptation planning by developing its National Climate Change Strategy.

The Bolivian National Climate Change Strategy (BNCCS) is an ongoing process to enhance adaptive capacity to respond to the levels of impact of climate change and its opportunities. Climate change and variability considerations will be highly relevant to the planning process so as to ensure food production, infrastructure and human health and generally to ensure economic development and social well-being.

This document complements the National Strategy by making recommendations to strengthen the governmental mechanisms and instruments, the institutional frameworks and the local, regional and sub regional actions. It also proposes application and evaluation methodologies for the National Climate Change Strategy.

Two National Strategy lines of implementation are also developed here: Human Security (including human health and food security) and Education and Communication for climate change. Resulting from consultation with institutions, the document brings together a number of priorities and actions to strengthen the adaptation to climate change, as well as preparing the general public to be aware of the risks of climate change, and to take the opportunities arising from the context of the UNFCCC.

2. INTRODUCTION

The international scientific community has been witness to a rise in the average surface temperature of the earth resulting from of an increase in greenhouse gas emissions in the atmosphere mainly due to the consumption of fossil fuels and changes in land use.

Even though the geological measurement has shown changes of similar magnitude (changes of different degrees to the earth's surface temperature) current global warming is alarming. These global changes may change the chemical composition of the oceans because of the melting of glaciers and large extensions of the polar surfaces. This will tend to change the circulation of the oceans and effect unimaginable consequences (tornadoes, hurricanes, tsunamis, etc.) as well as changes in rain patterns and the continental thermal regime.

These changes will have an effect on the crop yield, water availability, disease rates, road networks and human settlements.

The United Nations Framework Convention on Climate Change signed by most countries during the Environment and Development Conference (Río de Janeiro, 1992) had as its objective to stabilize the concentrations of greenhouse gases in the atmosphere to a degree that will impede interference with anthropogenic activities in the climatic system. According to the Intergovernmental Panel on Climate Change (IPCC) this means that the countries will have to carry out immeasurable efforts to reduce global emissions (up to 50% in the next 100 years if they want to stabilize the concentration of greenhouse gases in the atmosphere at 550 ppm.)

For a country such as Bolivia this implies a series of challenges that need to be taken on with insufficient support from the international community. We will have to coordinate the fight against poverty, biodiversity and hydric resource conservation, the generation of new opportunities in the rural areas and activities to mitigate and adapt to climate change to be able to ensure the well-being of the population.

In terms of the United Nations Framework Convention on Climate Change (UNFCCC), Bolivia as a NON-ANNEX I country will have to include its actions within the common but differentiated principle. This is to find new reciprocity equity and commitment levels among lesser-industrialized countries and those countries that have, throughout history, contributed to the greenhouse effect through their emissions.

Within this framework and in coordination with the sustainable development adopted by the country, Bolivia in eight years of participating in the UNFCCC has prioritized forest preservation as carbon sinks as it links in with the development of

sustainable practices of natural resource management and integral environmental management.

Within this framework Bolivia has elaborated the UNFCCC Bolivian National Climate Change Strategy (BNCCS) whose main purpose is to define a framework of policies to respond to climate change, developing institutional and legal frameworks that make technology transfer possible to prevent the generation of greenhouse gases and integrate measures for climate change adaptation into the national development planning as a way of implementing the commitments to the UNFCCC and other related commitments. Bolivia uses its existing institutional framework, which has been consolidated in the National Climate Change Program, as well as the Interinstitutional Climate Change Council, formed to discuss the national climate change policies with different governmental and non-governmental sectors.

This document responds to the need to have a framework of coherent actions for the management of the BNCCS. It defines the mechanisms and recommendations for the Bolivian government to apply the UNFCCC Bolivian National Climate Change Strategy in Bolivia principally through three spheres of action: (1) The government as a facilitator of climate change to spearhead information, training and education programs throughout all levels of society; (2) The consolidation of national capacities to finance projects for adaptation and mitigation of climate change through instruments connected with the UNFCCC and other bilateral sources; and (3) The coordination with the implementation of agenda 21 and the biodiversity, desertification, RAMSAR and the poverty reduction strategy.

This document also systematizes the actions that the general public should take on to adapt themselves effectively to climate change, ensuring that food reserves are grown sustainably, that there is no deterioration in the population's health, and working together with other actors to foresee risks. On the other hand this document systematizes the actions that the public should take on to understand and act upon climate change as a way of implementing the BNCCS education strategic line.

3. THE STRUCTURE OF BOLIVIA'S NATIONAL CLIMATE CHANGE STRATEGY (BNCCS)

3.1 The conceptual framework of the BNCCS

The UNFCCC Bolivian National Climate Change Strategy defines a conceptual framework aimed at including the actions that the Bolivian people should take on to confront climate changes.

The main pivot of the BNCCS conceptual framework is that the climate change policy should contribute to integral management of the environment. The first element of this conceptual framework, which is highly relevant to defining national priorities and the Bolivian position on the UNFCCC negotiations, is that Bolivia is a country highly vulnerable to the levels of impact of climate change, as well as having a good potential to mitigate climate change in the sector of Land Use, Land Use Change and Forestry (LULUCF) by reducing greenhouse gases in these sectors.

The strategy seeks coherent balance among the opportunities present in the UNFCCC and the obligations that the country should take on to ensure the well-being of the population. Even though the sale of carbon would bring investment for sustainable development, necessary for a country such as Bolivia, the activities that the country needs to carry out to respond to the levels of impact of climate change could put the advances achieved in food security and human health at risk and increase poverty.

The second element of the conceptual framework of the BNCCS is a discussion of mitigation and adaptation established in the UNFCCC to give greater integrity to the national response to climate change. The BNCCS includes both mitigation and adaptation within a single concept of society's adaptation to global changes. National and global society will be well-adapted when their productive and reproductive activities do not endanger environmental stability or, in other words, when they achieve lasting, sustainable development.

The advantage of this concept is that it includes the climate change mitigating activities be they within the LULUCF, or within the energy sector as productive sector adaptation activities and lead to clean development independent of the legal and institutional mechanisms that may arise from international negotiations.

The mitigation and adaptation to climate change activities, as complementary activities, would be integrated within the process of integral environmental management. For example, a mitigating activity that helps the conservation or recuperation of forests in catchment areas would also be a principle measure of adaptation to protect the availability and quality of water.

This concept offers greater flexibility for management of the topic given the formal restrictions usually placed on the UNFCCC mechanisms, as an adaptation measure could be seen as a mitigation measure if it reduces greenhouse gases. Companies interested in carrying out mitigation measures could receive carbon credits by supporting a climate change adaptation measure as an additional result. This concept opens possibilities to implement the UNFCCC logic framework and offers additional alternatives for implementing the Kyoto Protocol.

3.2 The strategic lines of the BNCCS

The BNCCS has defined four strategic lines for its development to generate a coherent implementation process. According to the BNCCS logic framework these four lines can be interlocking and share mechanisms but pursue different strategic objectives.

3.2.1 Productive empowerment and technological leap with the possibility of carrying out productive development using technological change to reduce greenhouse gases in the sectors more related to the production and transformation of energy as well as the sectors related to land-use change. The line of technology transfer and clean development aims to adapt the productive apparatus to new technological requirements, reduce the emissions and increase the efficient use of energy and non-energy resources.

The productive empowerment and technological leap activities can become measures to adapt to climate change in that they may reduce the precarious nature of the economy and lead to integral environmental management. On the other hand, measures for adaptation to climate change can be critical for the productive development in a set sector when it reduces the potential risks of external events and natural disasters faced by companies.

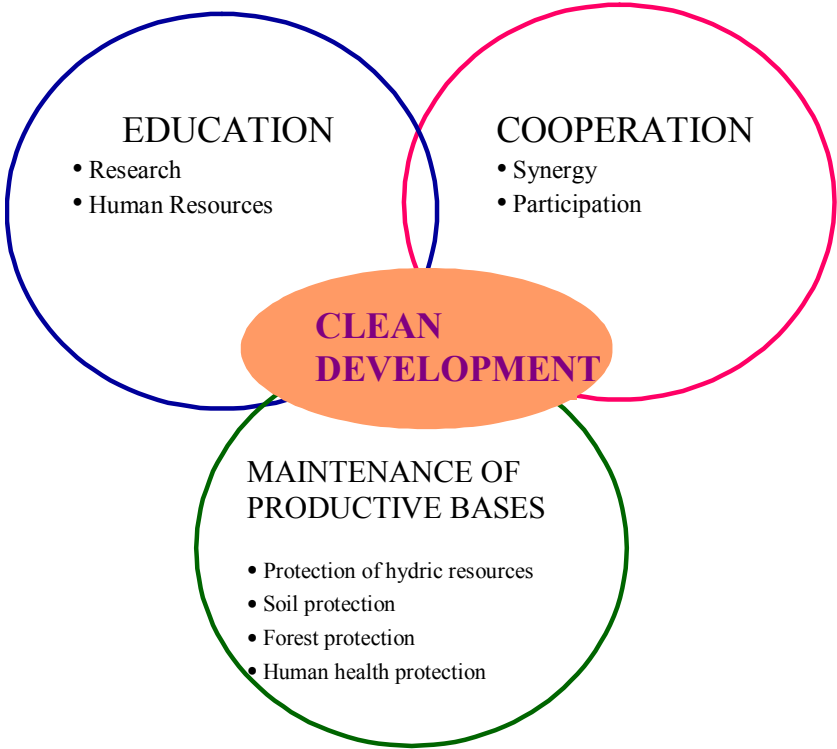
3.2.2 Human security, the BNCCS presumes that vulnerability to climate change is relative to the ability of humans to adapt. On the one hand the levels of impact of climate change can unforeseeably affect human undertakings and activities; on the other, society has a certain capacity to adapt in certain environments although some where this capacity needs to be strengthened and generated. Given that poor and vulnerable populations are more exposed to risk, coordinated actions need to be generated to develop efficient measures of response.

3.2.3 Education and communication for adaptation to climate change.

Adaptation to climate change requires society in general to begin to understand the topic and be able to act in a coherent and coordinated manner to respond efficiently to the levels of impact and repercussions (for example, modifying consumer behavior and lobbying the productive sector). The BNCCS believes that Bolivian society could begin to be trained in different aspects of adaptation to climate change and that the gap in national scientific research on the levels of impact and responses to climate change could be bridged.

3.2.4 Strategic alliances. The government firstly will have to coordinate better current actions on its environmental agenda with other governmental departments and then revise the additional work for society to develop lasting state policies and national capacities. This line is supported by the advances made by the country in terms of institutionalization and recommends generating the spaces necessary for coordination among the different implementation programs on agenda 21 as well as other state initiatives and policies at the same time as achieving coherent institutional frameworks to respond to the climate change requirements at the different levels of planning and action.

Fig. No. 1 BNCCS BASES FOR DEVELOPMENT

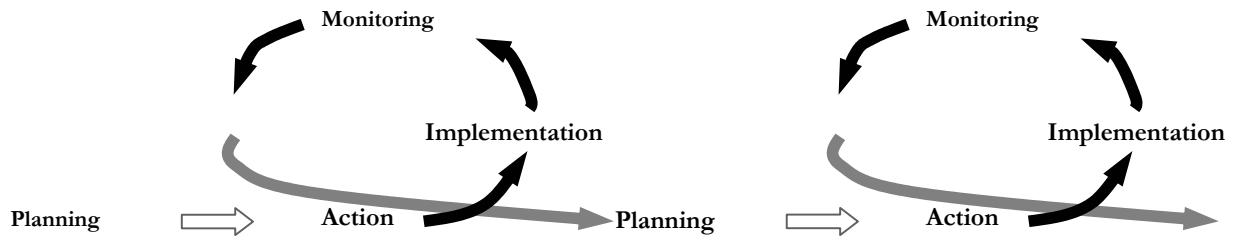


4. THE BNCCS IMPLEMENTATION PHASES

The BNCCS will develop cyclically through a learning process. This is why it is not recommended that the BNCCS application plans generate a program of activities and results. It will work along a broad timeframe (10 years) however, the current

institutional framework will have to take into account and promote the development of specific projects at the sectoral and regional levels that fall within the BNCC's implementation objectives as well as priority short, medium and long-term actions.

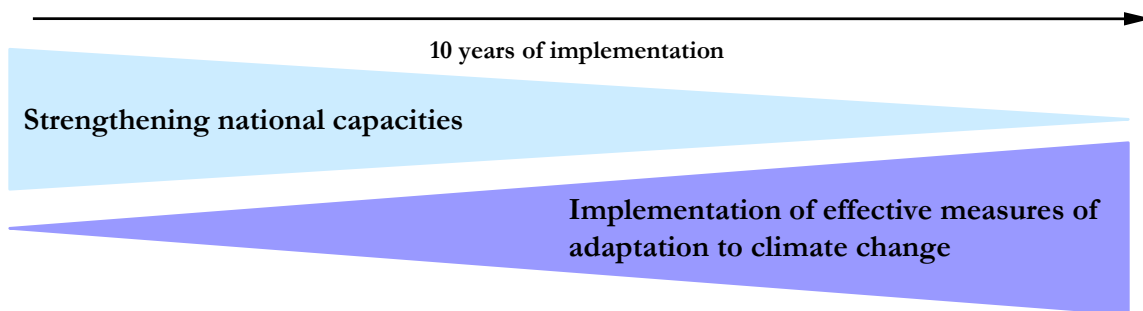
Fig. No 2: CYCLE OF ACTION, REFLECTION USED FOR THE IMPLEMENTATION OF THE DIFFERENT BNCCS PLANS OF ACTION



Over the 10 years, the capacity strengthening activities will be short-term but will continue to be restricted activities focused on some important sectors throughout the development of the BNCCS.

Figure 3 shows that while adaptation capacities are generated in the society, effective measures for adaptation to climate change will be generated.

Fig. No. 3: GLOBAL SCHEME OF THE BNCCS IMPLEMENTATION



5. GENERAL BASES FOR THE DEVELOPMENT OF THE HUMAN SECURITY STRATEGIC LINE

Within the conceptual framework mentioned above, a series of actions should be structured aimed at ensuring the development of human activities in the country given climate change.

The adaptation activities should be integrated into the same activities for food security, public health civil defense and complement other measures aimed at reducing greenhouse gas emissions, mainstreaming aspects of climate change when defining strategies, sectoral plans and public policies. This will be achieved through the generation of response capacities in the different sectors and spheres of society as well as the strengthening institutional capacities for dialogue, coordination and financing of the activities and projects within governmental spheres.

5.1 The levels of impact of climate change on food security

In order to better analyze the problem of food vulnerability in Bolivia we have distinguished between two ways of being exposed to the risk of food insecurity. The first is related to the socio-economic reality of the regions and is directly proportionate to poverty. The second is related to the exposure to natural disasters such as drought or flooding that drastically affect regional economies.

The 1992 population and housing census demonstrated that around 70% of Bolivians are below the poverty line with a marked difference between rural and urban populations. 94% of those living in rural areas are poor compared with 51% in the urban areas. Bolivia has one of the highest levels of urban poverty on the continent.

In the rural area, food is based on internal production thereby exposing homes to a high risk of food insecurity due to variations in farm produce. However food security problems in the cities are related to precarious employment conditions.

The different indexes elaborated¹ to identify the poorest and most vulnerable show Potosí, Chuquisaca and Cochabamba to be the departments with the highest rates of poverty, malnutrition and social vulnerability, particularly in the provinces in the Interandean dry valleys.

Very general studies show that one of the main causes of social vulnerability and poverty in the dry valley region is the environmental deterioration of these regions since the time of the Colony (Montes de Oca, 1998). It basically talks about soil

¹ Whether these be the poverty index, the human development index or the social vulnerability index.

deterioration caused by salinization and erosion, and also the seasonal scarcity of water all of which combine to limit agricultural production.

The 1994 Population and Health survey showed elevated indexes of acute malnutrition in children in Chuquisaca (14.6%) and Potosí (10%) due to drought (the national level is 4%).

ORSTOM has been studying the hydrology of 4 Andean glaciers in Ecuador, Peru and Bolivia. These studies have shown that the Andean glaciers have been receding since the 1980s (Pouyaud, 1997). The Quelccaya glacier in Peru receded at a rate of 3 meters per year between 1970 and 1990 and 30 meters per year since 1990.

The generalized receding of all the Andean glaciers may lead to the disappearance of the smallest glaciers in the next decades leading to unpredictable consequences for the mountain ecosystems. Various sources mention that the increase in temperature in the mountain regions may increase the amount of water falling in the form of rain and decrease the amount of snow. The result is more water in the rivers in the rainy season and little water in the glaciers in the dry season to feed the rivers. This may aggravate the water deficit in the dry valleys and increase food vulnerability in the region due to a lack of water for irrigation and human consumption.

The IPCC (SAR 1995) asserts that agriculture can maintain the baseline if the concentration of CO₂ is duplicated over the next 50 years (because of the fertilizer effect of CO₂), however two reports on the regional levels of impact of climate change (IPCC 1998, IPCC 2001) show a preoccupation with the an increase in hunger risk in some regions, particularly the tropical and subtropical zones because of an increase in temperature. Although it asserts that high and medium latitudes may experience an increase in crop yield, in the tropical and subtropical zones where the crops are located near the critical thermal maximum, crop yield may fall.

The studies carried out in Bolivia show a tendency for crop yield to rise in the high and medium latitudes whereas the crops grown on the plains are beginning to show signs of thermal stress. Potato crops show that the increase in temperature has a greater impact on yield than changes in precipitation (- 20% to +20%) even though a decrease of 505 in precipitation will mean total crop failure. Yields increase with temperature changes of up to 3°C but then begin to show signs of thermal stress due to evapotranspiration. The increase in yield is more obvious in the highlands than in the valleys and is strengthened by the increase in the concentration of CO₂ (MDSP, 2000, page 212 -213).

In the case of soya, there is a tendency in the Bolivian plains for the yield to decrease when the temperature rises. A temperature increase would begin to stunt the growth of the plant because it is using its energy for water uptake and

transpiration. There is however a benefit as CO₂ levels in the atmosphere duplicate as soya crops have a high compensation point.

National studies also show that although forage species would be able to increase their yields due to the effects of climate change, the cattle in tropical zones show signs of thermal stress and tend to lose weight.

No studies on the increase in cattle disease or changes in plague or disease patterns in crops have been carried out.

Thinking about contingency planning, the populations along the large rivers are exposed to the risk of flooding, not only in the low-lying areas but also in areas where the channels cannot hold any more water such as in the case of the valleys in the mountain regions. This is clearly related to the capacity of the glaciers to store water in the form of ice.

Another aspect is that of the climatic variability related to the effects of “El Niño” and “La Niña”. In 1998 a follow-up report on the “El Niño” phenomenon produced by the Ministry of Agriculture Livestock and Rural Development showed evidence of more than a 40% loss of maize and wheat production in the Chuquisaca, Cochabamba and Potosí departments because of drought. The drought also affected potato production in the first strike of 1998, a FAO report showed a reduction in the sowing area. In the same year, when the rainy season began, the government decreed a state of emergency and adopted contingency measures in the plains where the rains were causing floods. This pattern of pronounced droughts in the western area of the country and floods in the lowlands is repeated when the phenomenon of “El Niño” occurs.

5.2 Possible adaptation measures to ensure food provision

As regards the climate change adaptation activities, many of the actions agreed to in Agenda 21 are directly related to the possible adaptation measures to climate change. Some of the commitments in Agenda 21 are structural in nature such as Chapter 3 on the Fight against Poverty which programs economic development, social and environmental actions. Other commitments are more directly related to the possible adaptation measures, especially with some critical themes of national vulnerability to climate change.

Chapters 12, 13 and 18 are related to the management of fragile ecosystems, the management and protection of the mountain ecosystems, the fight against soil erosion and desertification, and the conservation of freshwater resources.

The implementation of these chapters in Agenda 21 has explained the need to establish regulations for soil and water resources. The draft Water Law has, since 1992, kept up the intention to regulate the use of water be it to be used for domestic, industrial or irrigation purposes as well as its management and

conservation. Many of this law's articles refer to the management of hydric resources and establish that the government will have to promote integrated planning and use of hydric resources, their protection and conservation. This is a necessary basis for the management of hydric resources, especially in the regions now showing signs of hydric stress.

To define policies on desertification and drought, the government has promoted the National Desertification Program (PRONALDES), and since 1992 has prepared aid plans for disaster especially in areas with a strong tendency to desertification. The Bolivian government has placed special emphasis on including aspects related to desertification on the education curriculum and generating early-warning systems within the National Early Warning System (SINSAT) for the government and private sectors to take decisions. The fight against desertification is linked to the hydric management measures mentioned above and also to other forestry management measures proposed by Agenda 21 within the Forestry Law that regulates the use of forestry resources. The VMENRFD National Watershed Directorate has defined the watershed as a basic planning unit for the development of adaptation measures.

In relation to forestry resources protection and the promotion of sustainable agriculture, the INRA Law is the mainstay of new agricultural management that uses soil and hydric resources rationally.

The implementation of chapters 15 and 16 is related to the protection of genetic resources and the safe use of biotechnology. The National Genetic Resources Conservation System wants the public to actively participate in the integral management of and benefit from genetic resources. Bolivia was one of the first countries to ratify [UNESCO Convention Concerning the Protection of the World Cultural and Natural Heritage](#). Using measures to take care of genetic resources germoplasm banks will be set up in the country. Their role to ensure the creation of species adapted to new climate conditions should still be evaluated.

Adaptation measures to climate change will be integrated into the framework of these activities aimed at ensuring a productive baseline for food production and achieving higher levels of food security. Adaptation measures to climate change are not activities isolated from other environmental security measures such as the reduction of water resources contamination, biodiversity protection and soil recuperation measures.

5.3 The levels of impact of climate change on human health and possible adaptation measures

Current advances in human health, characterized by an improvement in the sanitary situation of the population², life expectancy³, the eradication of certain

² Particularly in control of immunisable diseases

diseases and scientific advances in the mapping of the human genome and cloning, added to therapeutic advances in medicine and surgery⁴ have led to great expectations for repairing damage to health and give a positive future for the survival of humans. However the world is suffering from an onslaught of diseases – emerging, reemerging and new⁵ - such as AIDS⁶, Ebola, along with infections resistant to antibiotics, malnutrition and others associated with unhealthy lifestyles (smoking⁷) that all conspire against a healthy future.

Phenomena such as poverty, social and economic inequality clearly have an impact on health. These are increasing the already significant differences in health standards between lesser and greater developed countries.

Given this context, contamination, especially from productive activities, the use of fossil fuels, insecticides and heavy metals,⁸ (resulting from a development model adopted by humanity), is having a chain effect contamination – greenhouse gases - global warming with obviously serious consequences on the environment⁹, health and human security.

The global climate change arising from the chain effect described above is seen as an additional factor in the health – sickness process and makes its effects on human health be directly or indirectly felt¹⁰, when it is seen in increase in the incidence and prevalence of vector-borne diseases¹¹, the geographic and altitude extension of the endemic areas where specific pathologies are found, the reemergence of eradicated or controlled diseases, or the development of new pathologies.

The Intergovernmental Panel on Climate Change (IPCC) and other international organizations have confirmed through studies that the modifications in meteorological patterns resulting from global warming are facilitating the development of diseases through their altering of ecosystems, spurring on the development de bacteria, viruses, parasites and vectors, producing alterations in the thermal regulation of the human body, respiration, immunity and other metabolic processes, in response to changes in temperature, humidity, etc, that can not be adapted to thereby increasing the risk of disease and death.

³ Life expectancy has increased by over 40%, (from 46 to 66 years), however in less developed countries 3 of every 4 people die before reaching the age of 50 – global average 50 years ago

⁴ Such as transplants

⁵ At least 30 new diseases

⁶ 30 million people die every year of HIV – AIDS. This disease threatens everyone – children, adolescents and adults

⁷ 3,5 million people die each year of smoking related diseases

⁸ These remain in the atmosphere for between 70 to 200 years

⁹ Average global warming of 1.4 to 5.6°C will have serious effects on all ecosystems making it difficult for life to continue

¹⁰ Disruptions to the road and services networks, lack of water, flooding, destruction of houses, and an increase in diseases because of contamination of food and water.

¹¹ The changes in climate patterns favor vector-borne infectious diseases by generating a habitat conducive to their development, increasing possibilities for reproduction, decreasing incubation periods and increasing their capacity to infect

At the global level, infections and parasitic diseases sensitive to climate change and its variability stand out as the most frequently reported cause of death (WHO 1997), among these are found:

- 300 to 500 million new cases of malaria each year - a daily problem in over 100 countries around the world.
- Tuberculosis, once considered a disease of the past, has reappeared in such a way that it is now a global catastrophe causing the death of 2.9 million people each year in developing countries although a third of all cases is alongside HIV.
- Dengue has reappeared and become an important sanitation problem. In the last 3 years over 250,000 cases have been reported annually.

In the Americas¹², the reappearance of malaria and dengue in the 1980s and the beginning of the 1990s¹³, the increase in Hemorrhagic Dengue¹⁴ and the appearance of *Aedes albopictus*, as a new vector, have gone hand in hand with climatic variations, flooding and droughts, associated with political disruptions and social upheavals in many countries linked to mass movements of the population as refugees, displaced, and migrant workforces move to areas of greater economic and social development.

Along with cyclic meteorological phenomena such as “El Niño” (whether when they occur or in the following years)¹⁵, there have been outbreaks of diseases related to *V. cholerae*, *Campylobacter*, *C. botulinum*, *E. coli*, *Salmonella*, *Shigella*, Hepatitis A, Malaria, Dengue, Leptospirosis, Leishmaniasis, and Encephalitis, among others in the Americas.

In Bolivia, the epidemic profile shows that diseases transmitted by vectors (sensitive to variability and climate change), are responsible for deaths among the population. Among these **malaria** is on the rise¹⁶ reappearing in areas where there was none previously or where traditionally because of the altitude or weather this disease could not survive. On the other hand, infections caused by *Plasmodium falciparum* are being reported as resistant to common medicines making the situation more complicated and increasing healthcare costs¹⁷.

A study carried out by the National Climate Change Program in Bolivia¹⁸ has shown that malaria and leishmaniasis are sensitive to variations and changes in climate patterns that may favor the development of 30% of cases of malaria

¹² With the introduction of Dengue No.3

¹³ Malaria has moved outside its traditional areas thereby increasing the number of people at high risk

¹⁴ The vector, *Aedes aegypti*, and the 4 serotypes of dengue are widespread in the Americas

¹⁵ Dengue

¹⁶ There were 24.891 cases registered in 1987 and 64.135¹⁶ cases in 1996 in eight of the nine departments, six of which are high-risk areas

¹⁷ 15% to 45% were reported to be resistant to chloroquine, mainly in Riberalta and Guayaramerín in the Beni department and part of the Pando. In 1996 hospitals reported 14 people dead of malaria.

¹⁸ “Vulnerability and Adaptation of Human Health faced with the Effects of Climate Change in Bolivia” PNCC, VMENRFD, MDSP, PAHO/WHO, GEF/UNDP

(11.3% produced by *vivax* and 43.6% produced by *falciparum*) and 34% of new cases of leishmaniasis.

Given this, the worldwide sanitary efforts headed by the WHO¹⁹, and the PAHO²⁰, through their health education prevention, promotion, strategies, improvement of access to healthcare and attention to damage have achieved important advances in health. However, these organizations need to dedicate more time and effort to environmental aspects, mainly those related to the climate where until now their efforts have been perfunctory.

In the climate ambit, the international community has begun a series of national and international movements aimed at decreasing environmental damage, understanding the climate change phenomena and beginning mitigation measures. Among these The United Nations Framework Convention on Climate Change²¹ incorporates the topic of human health in clause (f) of Article 4 or the Commitments²² and the Sustainable Development and Environment Summits, such as the Earth Summit that, in Agenda 21, signals a series of initiatives for action in health from an environmental and climate point of view.

The national policies and strategies on disease control stimulated by the national government are contained within the Strategic Health Plan (SHP) that makes the “Epidemiological Shield” a priority. This is the main strategy of the fight against vector diseases such as Chagas and Malaria²³ that are sensitive to climate change and variability.

The PNCC, through education, diffusion and communication for climate change and its promotion of studies on climate change and human health, is promoting adaptation measures throughout the country that nevertheless should be internationally implemented given that the diseases sensitive to climate change are not limited to just one region of the world, or only found in developing or developed countries. These are a general threat and demand a coordinated response from the health systems in all countries who should shoulder the financial burden for prevention, control of epidemics and the healthcare of the patients.

¹⁹ The goal “Health for Everyone in 2000” (SPT) has been replaced by the new global health policy “Health for Everyone in the 21st Century”¹⁹ approved by the WHO thereby renewing the SPT goal

²⁰ This institution was created by the WHO as a regional office for the Americas

²¹ This seeks to generate the necessary mechanisms to stabilize the concentration of greenhouse gases in the atmosphere to a level that impedes dangerous anthropogenic interference in the climatic system. This level should be brought about gradually for ecosystems to adapt naturally to climate change, ensure that food production is not threatened and allow socio-economic development to be sustainable. (Art. 2 UNFCCC Objective)

²² “Take into account as far as possible climate change in its relevant policies and social, economic and environmental measures and employ appropriate methods, for example, impact evaluations formulated and coordinated nationally with a view to minimizing adverse effects on the economy, public health and environmental quality, of the projects or measures undertaken to mitigate climate change or adapt to it”

²³ Until now the programs aimed at these diseases do not incorporate climate change’s impact on human health, which is contemplated in one of this Plan’s objectives

TABLE 1: SANITARY MODIFICATIONS TO ACHIEVE THE INCORPORATION OF CLIMATE CHANGE

AREAS OF CHANGE	CURRENT SITUATION	MEASURES REQUIRED	GOALS
Information	Little information for health personnel, the media and Bolivian population on the levels of impact of climate change at national and international levels	Promote the incorporation of the topic at a subjective level because of demand and healthcare	Bolivian civil society and sanitary organizations with a minimum knowledge of the topic
			Media has basic, factual knowledge of the topic
Knowledge	Little or no training in climate change for health personnel in universities, public health schools, research institutions, professional associations, etc.	Promote the incorporation of the topic into healthcare education reinforcing the environmental and climatic focus	Human health resources with a solid training in climate change and its levels of impact on the health of the national and international population
		Promote the incorporation of the topic within the main research priorities in health institutes and schools of medicine	Scientific community supporting national and international knowledge
Actions	National Health System unaware of vulnerability, levels of impact and adaptation measures to climate change in health	Promote the incorporation of the topic in the sanitary planning and regulation system	Those in charge of Health Sectors and Departments developing strategies and policies for the adaptation to and control of sanitary levels of impact of climate change
	Little public or civil organization participation in their health preservation relative to climate change.	Promote the incorporation of the topic in the sanitary attention system	Hospitals, Health Centers, health districts offering prevention and curative services with knowledge of levels of impact of climate change
		Prepare positive programs that promote participation	Labor, religious, company, partnership, cooperative, youth, Grass Root Territorial organizations working on the prevention and adaptation to climate change in health

5.4 The levels of impact of climate change on rural and urban infrastructure

Since the 1980s there has been evidence of more intense and frequent manifestations of the phenomena of “El Niño” and La Niña. These bring heavy

rains in some regions and drought in others. Both rains and drought damage the road networks in rural and urban areas. Whereas flooding directly damages the infrastructure, drought also has its levels of impact mainly due to the desolation of the regions. It is also known that “El Niño” is striking more frequently and intensely because of climate change. On the other hand climate change is accompanied by changes in high and low pressure levels bringing strong winds, cyclones, tornadoes and hurricanes throughout the continent.

Damage is seen through all sectors, however it is more evident and could have serious consequences if the sanitary infrastructure is compromised due to the fact that health centers are reference points for the sick and injured and are mainly their only chance of survival.

The climatic models developed by the PNCC 1997 and SENAHMI 1999 show a clear tendency in an increase in rains in the rainy season in humid areas, and a decrease or irregularity in the rain patterns in the dry season. It is very probable that the rains will be more intense in some regions even without the presence of an event of climatic variability. This will mean an additional burden on the rural and urban infrastructure, especially on the country’s communications and transport systems.

The country has developed a civil defense system that responds to emergencies produced by external events. There has also been special emphasis placed on the prevention of disasters.

However there is still a vast institutional gap to carry out long-term predictions of global climate change and to develop actions aimed at adaptation.

To reduce the levels of impact of climate change on infrastructure, new ways of construction and implementation of the infrastructure incorporating aspects of climate change during the projection will need to be reviewed.

Also, a series of studies being carried out on the risks of flooding may guide the development of human settlements and lead to some preventative measures for reducing the risk of disasters.

5.5 Additional adaptation actions proposed by this document

The additional adaptation activities are for different planning levels. At the governmental level they are related to communication, information and education activities as well as through governmental coordination measures and the consolidation of the mechanisms of evaluation and monitoring of advances gained in the theme.

Adaptation measures at a sub-regional level are related to the coordination among different sectors and municipalities for the development of integrated regional projects that include aspects of climate change within their activities.

Adaptation measures at a local level are strongly linked to technological improvement and adjustment for resource management and to reduce the dependency of productive activities on climate changes and variability.

The governmental mechanisms to coordinate, discuss and finance these projects are described in Chapter 6 of this document.

CHART No 1: FRAMEWORK OF ACTIVITIES FOR ADAPTATION TO CLIMATE CHANGE POLICIES

<p>Adaptation activities at a national level</p>	<ul style="list-style-type: none"> • Institutional coordination activities for integral environmental management • Institutional coordination activities for the international negotiation of environmental themes • Consolidation of governmental instruments for the evaluation and monitoring of advances made in environmental obligations • National Services of early warning, epidemiological vigilance and civil defense
<p>Adaptation activities at a sub-regional level</p>	<ul style="list-style-type: none"> • Regional projects for environmental management (protection of the biodiversity, desertification, climate change) • Specific and regulatory legislation • Regional services for technology transferal (public – private) • Regional training and education services (linked to activities of the Education and Communication strategic line)
<p>Adaptation activities at a local level</p>	<ul style="list-style-type: none"> • Environment management projects • Technology improvement and adaptation

5.6 Priorities for the implementation of the human security strategic line

(Results from the Human Security working group)

FOOD SECURITY

1. Make the general population and the institutions as well as the government and civil society aware of the magnitude of the problem of climate change and its possible repercussions on agro-alimentary systems,
2. Integrate adaptation to climate change measures and programs within the current governmental, municipal and civil society activities,
3. Study in depth the repercussions of climate change on the ecosystems and hydric resources, and how these changes affect food production,
4. Study in depth in eco-productive regions the levels of impact of climate change on the phenology of the main crops and the density and distribution of plagues and diseases,
5. Study the sensitivity of tropical crops to climate change, especially rice, maize, sugarcane, cassava, bananas, citric fruits, coffee and legumes.
6. Develop effective ways of empowering local levels to generate the capacity to adapt to climate change and develop successful experiences in adaptation to climate change, with the participation of civil society and the scientific community.
7. Generate an institutional framework responsible for information, extension and financing of adaptation projects.

HUMAN HEALTH

Short-term measures

1. Develop information, education and communication activities so that the scientific community, the national authorities and the general public are aware of the influence of climate change and climatic variability on human health.
2. Diffuse the studies carried out in the country on climate change and human health, so that they become a model for the development of specialized research.
3. Request that international financing organisms include the topic of climate change and health within their cooperation priorities.

Medium-term measures

4. Promote vulnerability studies and the elaboration of adaptation measures aimed at reducing the impact of climate change on health on the part of medical research institutes in the country.
5. Establish interministerial action bases and work lines²⁴ that permit an integral focus of the fight against diseases transmitted by vectors or others based on knowledge of climate change in the country.
6. Identify and formulate adaptation measures and strategies to reduce the impact of climate change on the health of the Bolivian population. These will be designed from an interdisciplinary point of view and should rescue the experience gained by the Ministry of Health in the fight against diseases transmitted by vectors or others and include the support for environmental strategies or others by the Ministry of Sustainable Development and Planning.
7. Implement research programs aimed at studies on vulnerability, adaptation and mitigation of the effects of climate change for prevalent diseases within the national health priorities.
8. Develop implementation strategies designed by administrative levels (national, departmental and municipal) with wide social and community participation to reduce the impact of climate change on

²⁴ Initially between the Ministries of Health and Social Security and the Ministry of Sustainable Development and Planning

the health of the Bolivian population.

9. Carry out cost efficiency and cost benefit studies on the different measures used and to be used to reduce the effects of climate change on human health.

Long-term measures

10. Design and implement follow-up and monitoring systems of diseases transmitted by vectors or others (highly sensitive to climate change and climatic variability), through integrated "Bioclimatic Vigilance" mechanisms.
11. Establish coordination programs with the institutions in charge of monitoring new human settlements, colonies, petrol companies, mining companies, etc. in endemic zones to give information about the risks, and measures that temporary or permanent emigrants should take.

RISKS AND CONTINGENCIES

1. Establish areas at risk of drought, flooding, landslides and epidemics and how these can change due to the impact of climate change, to establish adaptation measures.
2. Develop the regulations necessary to ensure the communications and urban infrastructure prone to climate change.
3. Develop together with the institutions responsible for civil defense the corresponding adaptation measures.

6. GENERAL BASES FOR THE IMPLEMENTATION OF THE EDUCATION AND COMMUNICATION FOR THE CLIMATE CHANGE STRATEGIC LINE

Education can be defined as a process and as a result of this process²⁵, and so education as a social process consists of the constant transmission of cultural values from the adults to the young people to ensure the continuity of the culture and social organization as well as the progress of the civilization through analysis, criticism and constant revision of these values.

Education is mainly acquired in schools, the family and the society. This is why when a change in behavior is required these three ambits are influenced.

If the social process of education were stopped around the world, in less than a century humanity would lose everything gathered in centuries, knowledge, beliefs, ideals, social organization, mental, moral and technological resources – its cultural heritage.

As an individual process, education consists of progressive accumulation by each individual of the values, knowledge, beliefs, ideals and techniques of humanity's cultural heritage as well as the methods used to create new cultural values.

Education also encompasses a group of knowledge, aptitudes, actions, however, values play a large role as through them knowledge and aptitude can be transformed into attitudes and actions.

Education and communication enables the challenge of climate change to become an opportunity to instigate a development model that does not limit the national growth, improves incomes and the quality of life of the citizens. With this as its objective, a change in the collective rules and individual conduct²⁶ could have significant effects on the emission of greenhouse gases and even more if carried out within the complex, regulatory and legal institutional spaces.

Social Learning and Innovation and Changes to the Institutional Structure will be able to Contribute to the Mitigation of Greenhouse Gases and Decrease Vulnerability to Climate Change

²⁵ Matos A. Luis from “Compendio de Didáctica General “. Editorial Kapelus 1963. Pages 22 -24

²⁶ Through education

The above mentioned changes when incorporated into the collective rules and individual conduct will generate new cultural values (Table 2), that will improve the individual and organizational behavior providing opportunities for adaptation and mitigation in the short-term as well as in the long-term alongside technological advances²⁷.

TABLE 2: CULTURAL MODIFICATIONS TO BE ACHIEVED FOR CLIMATE CHANGE EDUCATION

AREAS OF CHANGE	CURRENT SITUATION	MEASURES REQUIRED	GOALS
Knowledge	Little information on climate change at a national level	Promote the incorporation of the topic into formal, non-formal and informal education	Bolivian population and organizations with basic knowledge of the topic
			Media has basic, factual knowledge of the topic
			Scientific community supporting national and international knowledge
Aptitudes	Society constantly changing personal values system	Construct new ways of analyzing and seeing problems	AWARENESS RAISING
	Lack of respect for the environment and biological diversity	Develop a spirit of criticism, responsibility, tolerance, respect for all forms of life, participative conscience and solidarity	
Values	Loss of moral values due to individualism, consumerism and utilitarianism	Promote education in climate change based on moral values for social transformation to respecting the environment	
	High poverty indexes	Promote demonstrations of the economic advantages of the sustainable use of resources	
	Lack of employment		
Attitudes	High rates of corruption	Promote censure from the point of view of climate and the environment	PRODUCTIVE STRENGTHENING AND TRANSFORMATION Clean Development, Reduction and Mitigation of Emissions Technology jump for development HUMAN SECURITY
	Imperious economic model	Generate actions to establish that it is no longer viable to separate the environment from development (Río 1992)	

²⁷ As a result an improvement in socio-economic potential will be achieved, especially if the change in regulations and cultural preferences lead to decreasing the emissions to sustainable levels.

Actions	Little citizen and civil organizations participation in the preservation of the environment	Prepare positive programs that promote participation	Labor, religious, company, partnership, cooperative, youth, Grass Root Territorial organizations working on the prevention and adaptation to climate change in health
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These innovations are frequently met with resistance so education and communication in climate change will have to demonstrate common benefits such as:

- The increase in energy efficiency for industry does not only mean a decrease in greenhouse gases but also creates a cleaner and healthier atmosphere and greater competitiveness.
- The modernization of public transport systems or the reduction of contamination produced by vehicles also brings better services and cleaner air for all.
- The development of renewable energy does not only avoid emissions but also promotes new technology and employment opportunities.
- As the development of adaptation measures for example for infrastructure projects linked to renewable energy projects, transport systems and constructions lead to longer lasting benefits, this generates economic resources that can be used in other priority areas.
- The evaluation of the vulnerability of human health showed the high susceptibility of the Bolivian population to the increase of infectious diseases, and particularly those transmitted by vectors, all of which makes it necessary to implement adaptation measures that enable the environment to play a role within the National Health Programs, include the topic of climate change in the epidemiological evaluation and strengthen environmental health education in the sector finally achieving a reduction in the population's exposure to these diseases and their consequences.
- The implementation of adaptation measures in the agriculture sector at risk of suffering desertification, salinization, destruction of vegetative cover, deforestation etc., will allow, though a better management of waters and soils, biodiversity, education, research and technology transfer, adequate availability of the national food requirements and generate income through the exporting of agricultural produce.
- The sustainable management of the different sectors and the implementation of adaptation measures for example of forestry

resources, will allow the generation of development processes through taking full advantage of wood and its waste products.

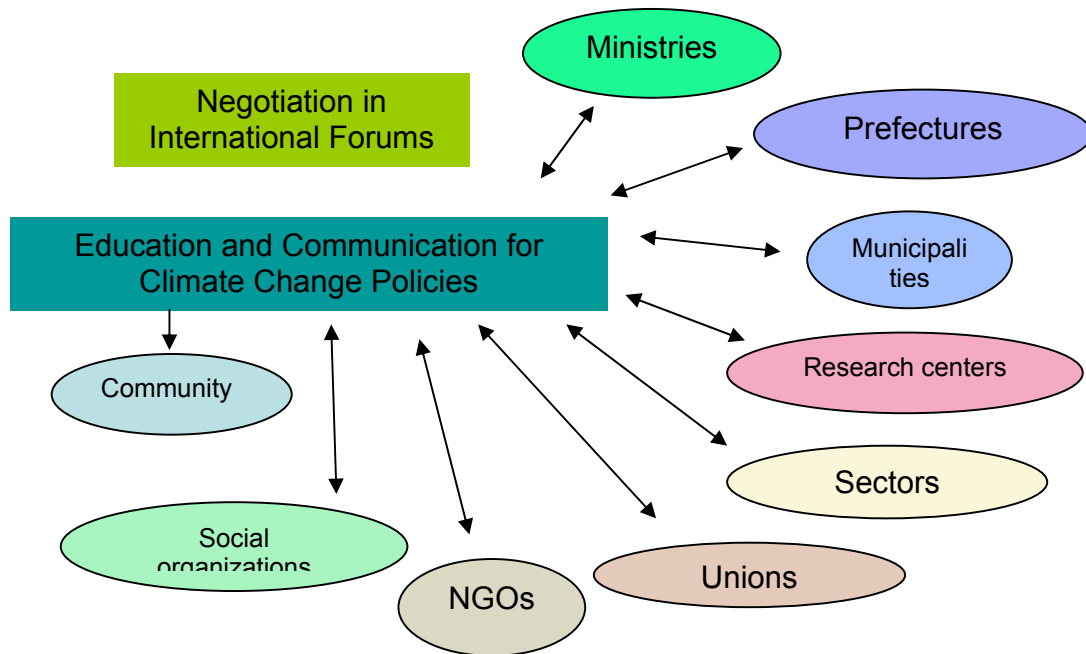
- The adoption of contingency plans, works to transfer catchment basin waters, an improvement of early warning systems for flooding and droughts, training and education in the management and consumption of water as adaptation measures in this sector, will ensure the availability of this resource for both personal and productive use at the same time as decreasing the risks and contingencies.

As an additional strategy to overcome resistance, public participation in decision-making should be increased, which will lead to sustainability and equity of the measures.

6.1 Education and communication actors for climate change

Only with a positive and open approach can efficient responses be formed and executed, hence the need for all of Bolivian society, the government, companies, social and citizen organizations to participate in education policies. International interaction is also indispensable to gain maximum results when looking for global benefits. (Figure No. 4)

Fig. No. 4 ACTORS IN CLIMATE CHANGE EDUCATION

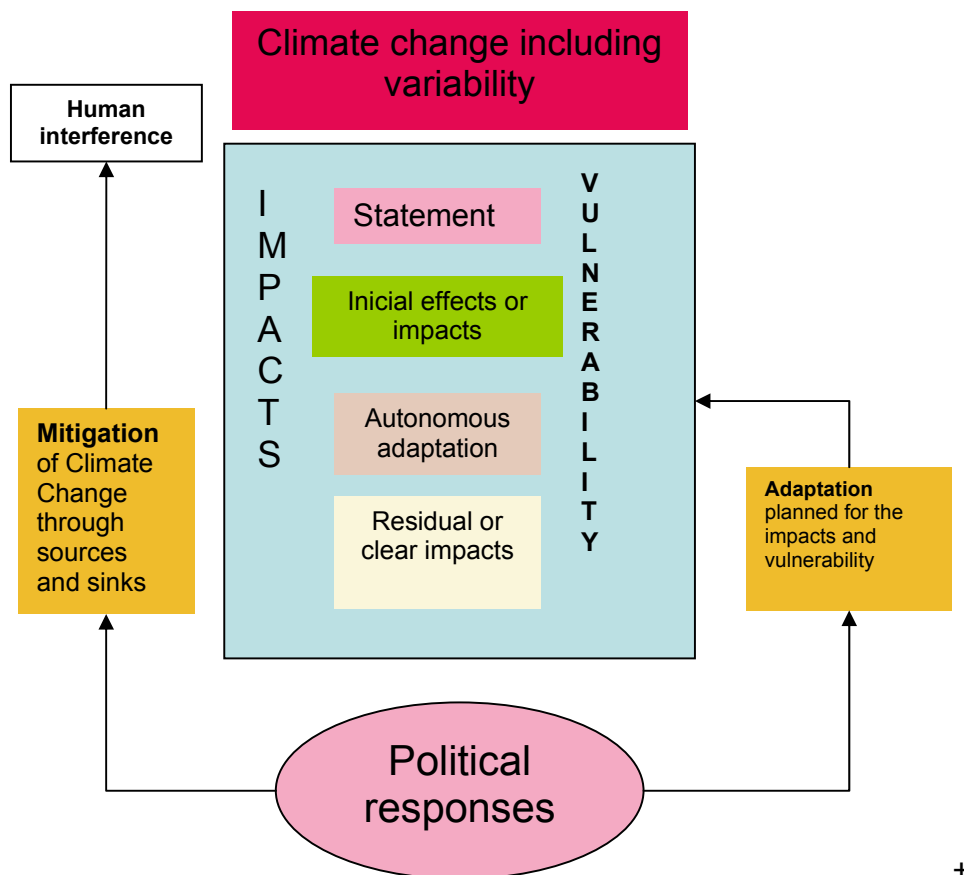


The education policies should favor the recognition of forces that conspire to deplete natural resources, pollution and the increase in greenhouse gas emissions, and strengthen the ties and strategic working alliances with the scientific community, policy makers, social actors and the general public nationally and internationally.

6.2 Areas to be covered by education and communication for climate change

Without limiting the national economic development and favoring sustainable development, the Sectoral Plans for Action in Education and Communication for Climate Change²⁸ will have to integrate policies, plans and actions aimed at mitigating the emissions of greenhouse gases, reducing vulnerability and favoring adaptation to the impact of climate change. (Figure No. 5)

Fig. No.5 AREAS THAT EDUCATION AND COMMUNICATION IN CLIMATE CHANGE SHOULD COVER



²⁸ Taking into account the General Lines developed in this document

This document should become a point of reference for the generation of specific plans²⁹ for education and communication for climate change (to be developed within the relevant sectors), or for climate change to be incorporated into the current education programs in each sector. For example, in the Ministry of Agriculture there is the Food Security Program (FSP), the Highland Dairy Development Program (HDDP) and the Rural Development Program (RDP)³⁰ that develop education strategies and activities. These should now include topics on the reduction of emissions; decrease of vulnerability, and the design of adaptation measures in their responsibilities and finally lead to the incorporation of the topic in the sectoral development plans.

Following the points developed in the Strategic Line of Education of the National Strategy for the Implementation of the UNFCCC (BNCCS), and to generate a coherent policy framework, this chapter sets forth actions aimed at generating capacities necessary for Bolivian society to respond to climate change through short, medium and long-term actions³¹.

At the same time, it partially modifies the framework proposed by the BNCCS based on priorities detected during the diagnosis carried out prior to this work. The following spheres of action have been selected:

1.- Development of scientific capacities

2.- Training of policy makers

3.- Incorporation of the topic into the formal education systems

4.- Creation of social awareness and sensitization

5.- Training of highly vulnerable groups and rescue groups

6.- Climate change in development

6.3. Development of scientific capacities

In general terms, the research in the country lacks the economic resources and continual training necessary to confront the current complex challenges and, more so, a topic as new as climate change³²

²⁹ In those sectors where they do not exist

³⁰ This program has two components; one aimed at the preparation of high school graduates in the humanities, and the other in livestock diplomas

³¹ The priorities are based on the information gathered during the diagnosis, elaboration and discussion workshops for this work.

³² Traditionally the country's policies have responded to current necessities generated by poverty and there is still no response to the harmful effects of plundering and unsustainable use of natural resources.

Because of this the PNCC should be the driving force behind the research, characterized by a first stage where the program should carry out studies³³, and a second stage to continue these in tandem to strengthen research institutes and other centers related to climate change. The third stage would come when the pectoral degree of knowledge within the research centers is adequate and they are able to take responsibility for the studies and finally take on the administration that a state institution should execute.

In the long-term, the fields of action should become worthwhile objectives and tangible support for the implementation of the UNFCCC in Bolivia such as:

- *The national scientific community contributing knowledge about climate change nationally and internationally.*
- *Promotion of the publication and diffusion of the research on climate change at the national level.*

6.4. Training of policy makers

The hierarchical levels of the national, departmental and local government (mainly the Regulatory Bodies) need to be trained in sustainable development and particularly climate change so that they incorporate the subject into their decisions favor higher response levels and overlap the issue when developing policies, strategies and direct and indirect actions.

The direct education of technicians, middle-level management and other local, departmental and national government functionaries should be promoted as they are the sectors that can give continuity to the policies and response strategies to climate change.

The private sector, because it has influence on the political decisions and decision-makers, should also be included in the training in environmental management and climate change.

6.5 Incorporation of the Topic into The Formal Education System

The national education system, currently being reformed, is still lacking coverage. However, thanks to the efforts of the national reform there should be an improvement.

The education and communication strategy for climate change should strengthen and contribute to the lines of BNCCS Productive Empowerment and Technological Leap, and Human Security.

³³ Being carried out for the PNCC with other institutions to develop research in climate change

6.5.1 Formal Education

Attitudes towards the environment are generally acquired in childhood and are further developed throughout school years. This is why the environment and climate change in particular should be incorporated within the education curriculum, prioritizing topics depending on the regions, their vulnerability³⁴, adaptation capacities, mitigation possibilities, and mainly their development opportunities³⁵.

The international community is elaborating or has completed the design of formal education curriculums to include the topic of global environmental changes. These curriculums can find similar subjects nationally and replicate them in education³⁶.

For formal education³⁷ curricular programs should be developed that have an integral conceptual content, i.e. that includes considerations and themes such as vulnerability, mitigation, adaptation to climate change³⁸, and those set forth by the UNFCCC.

The contents of the education curriculum in climate change will have to be analyzed and discussed within the framework of sustainable development and systematically detailed in the education reform, which is now in the design phase.

Formal education should be accompanied by modern teaching methods, such as those provided by technology, and so web pages, tournaments and virtual-fairs on climate change should be designed for children.

6.5.2 Alternative and Nonformal Education

Cultural changes and attitude for ethical construction sought alter through this type of education should be strengthened through parallel processes aimed at awareness raising – that implies a transformation of values – on climate change throughout all levels of society.

Nonformal education should support the current environment education programs, and place emphasis on the introduction of production technology and cultural changes in health and values for living together and mutual cooperation (BNCCS), the topics of environment and climate should also be incorporated into the training of private sector workers.

³⁴ Deforestation, burning, desertification, diseases, droughts, flooding, etc.

³⁵ ENI produce transformation

³⁶ Climate Change Action Fund Public Education and Outreach Projects (PEO) Canada

³⁷ At all levels

³⁸ The causes and effects of change

6.5.3 Informal Education

Informal education is the knowledge, aptitudes and values that are learned informally. We consider that the ethic premises of the social agents (governments, companies, religious groups, the media, etc.) can contribute to the clarifying of the current situation and found more solid, real starting points when actions for the mitigation and adaptation to climate change are planned. This type of education will be considered within the following point or creation of a public awareness.

In the long-term, the lines of action should become worthwhile goals and a tangible support to the implementation of the UNFCCC in Bolivia such as:

- Bolivian population respectful of the environment, trained to avoid environmental and climate damage.
- Bolivian population adapted to and active when faced with climate change.

Training in climate change should first be aimed at:

- The existing training and education units in the different sectors, for example the Ministry of Agriculture PASA, PADER, PDLA programs, or the Ministry of Energy and Hydrocarbons UMA, UEM programs
- Strengthening the topic of climate change in the existing post-graduate programs in the country
- Designing and elaborating adequate educational material aimed at education for climate change in the formal as well as the alternative system

6.6. Creation of social awareness and responsibility

So that society changes its patterns of conduct and participates in environmental and climate decisions, it is necessary for it to understand that climate change and its levels of impact affect it now and in the future.

Therefore, public meeting, discussion and participation need to be made dynamic as the produce transformation policies require a high degree of public awareness that can only be achieved by involving the entire population in the construction of the agreements as well as the materialization of the actions. For this the participation of the companies, NGOs, unions, cooperatives, professional associations, social agents, religious groups and citizens is required.

The preparation of journalists in the topic of climate change should be the first task to create public awareness as they are the strongest orientating or disorientating force that the media has.

The use of the mass media is therefore one of the most effective channels for creating public awareness of climate change, and so both the written press as well as radio and television should be used at the same time as giving them written and electronic material on climate related topics and firstly explain the causes of global warming and its origins, followed by themes such as vulnerability, adaptation and mitigation of emissions.

Local and national campaigns should be prepared and a systematically organized series of audiovisual material for the civil population to receive simple but clear information on climate change and its implications.

The climate change phenomenon should cease to be a subject exclusive to experts and become a social concern and petition, therefore citizens' participation, the sensitization of NGOs and the media information are necessary.

Religious groups³⁹ have an undisputed influence on society and so should be incorporated if we want to achieve public awareness of climate change. This training of religious leaders and clergy in environmental management and vulnerability and adaptation to climate change is particularly important.

The work of young people through special events such as school competitions, youth marches, art competitions, workshops and exhibitions on the effects of climate change and the possibilities of reducing emissions, adaptation and vulnerability reduction at a community level is important to create public awareness.

Workshops and seminars for unions, NGOs, businesses, cooperatives, associations, professional associations and other civil organizations should also be considered.

In the long-term, the lines of action should become worthwhile goals and a tangible support to the implementation of the UNFCCC in Bolivia such as:

- Celebrating the prevention of climate change day in Bolivia with the NGO networks, the media, civil organizations, etc.
- Environmental and climate activist groups developing daily activities.
- Community groups, citizen groups, neighborhood boards, etc. working for the prevention of climate change.
- Oral and written press actively working on the topic of climate change.

³⁹ There has been a growth in religious groups, Catholics, Evangelicals, Jews, etc becoming involved in climate change internationally.

6.7. Training of Highly Vulnerable Groups and Rescue Groups

The studies on vulnerability and adaptation to climate change and the analysis of mitigation of greenhouse gases carried out by the PNCC (1997) establish the bases for defining areas especially vulnerable to the effects of climate change. Therefore the priority areas and sectors particularly susceptible to the direct effects of climate change should be trained early on to prevent the presentation of the effects and minimize the levels of impact.

The population living in areas susceptible to drought, flooding, soil change and those who will soon suffer the effects of climate change and do not know about the rising risks should be promptly trained with the aim of reducing the levels of impact.

For these same reasons the rescue groups that already have training to face certain situations in areas traditionally at risk should be upgraded to prevent and attend to direct effects in new zones of levels of impact due to climate change.

The municipalities in areas vulnerable to the effects of climate change should be integrated early on into the education policies with the aim of promoting local strategies and actions to prevent the harmful effects climate change.

In the long-term, the lines of action should become worthwhile goals and a tangible support to the implementation of the UNFCCC in Bolivia such as:

- Rapid response groups for the effects of climate change prepared and working.
- Zones highly susceptible to the levels of impact of climate change adapted and prepared to minimize their vulnerability to the effects of climate change.

6.8 Education for climate change and development

The Decentralization and Popular Participation Laws and the popular participation process generated are enabling municipal strengthening, locally-based decision making, greater local investment and higher levels of development in previously neglected zones of the country with the objective of improving the population's relationship with the earth and the environment.

Popular participation is also aimed at improving the areas bypassed by Bolivian society through new mechanisms for rural promotion and the channeling of productive strength through the productive municipality (BNCCS).

At the national and departmental levels, the National Education and Communication Plans for Climate Change should work to incorporate the topic of climate change into the development policies and sectoral action plans.

At the departmental level there needs to be an intersectoral organism for climate change that initially heads the education and communication process and later the departmental mitigation, vulnerability reduction and adaptation activities.

The local level can easily become the generator of a new type of sustainable development into which are woven topics related to climate change. The possibility of promoting local projects and the availability of additional resources thanks to popular participation, Decentralization, and the funds to be distributed by the National Dialogue Law could implement a series of mitigation, adaptation and vulnerability reduction measures by setting up projects such as:

- Environment management projects,
- Residential energy conservation projects (energy and water conservation, efficient lighting, etc.),
- Cleaner production and environmental management in small and medium industries projects, cleaner production and environmental management in hospitals, (energy efficiency and the use of renewable energy, prevention of contamination)
- Carbon capture and forestry renewal projects, etc.,

It should be highlighted that at a local level education must include local demonstrations of the advantages and ease of the measures of, for example, mitigation, in terms of cost-reduction and the decrease in emissions.

In the long-term, the lines of action should become worthwhile goals and a tangible support to the implementation of the UNFCCC in Bolivia such as:

- Models of sustainable production and consumption in application
- Working alternative, non-polluting energy
- Drastic reduction in greenhouse gases
- Bolivian society adapted to and minimally vulnerable to climate change

6.9 Cross-cutting themes

The lines of action described above can be enriched by the cross-cutting elements.

1) Prioritize the education and communication for climate change actions taking into account gender aspects:

An educated man ... is an educated man
An educated woman ... is an educated family

2) The audiovisual and printed material to be developed for the education and communication for climate change plans should be adapted to social characteristics and the language specific to the target groups.

3) The education and communication for climate change activities should be carried out with the Ministry of Foreign Affairs, the Embassies of friendly countries and the international cooperation agencies initially with the aim of disseminating the topic and later channeling the financial resources into the educational activities of the different sectoral education plans for climate change.

4) The diffusion and communication for climate change activities should not be limited to one or two sporadic activities but rather should be frequent and aimed directly at the public, for example publishing pamphlets every 3 to 6 months.

6.10 Priorities for the implementation of the Education and Communication Strategic line

DEVELOPMENT OF SCIENTIFIC CAPACITIES

Short-term measures

1. Elaborate sectoral education plans as per the PNCC components to generate or strengthen the research capacities in the area of mitigation, adaptation and vulnerability reduction for the universities and institutes of the country.
2. Strengthen the National Research Institutes in the different sectors.
3. Train the National Research Institutes staff in climate change themes.
4. Request and channel international cooperation resources for the development of research topics.
5. Strengthen of systematic observation of climate change capacities through improvements in the data and information acquisition and interpretation systems.
6. Increase the understanding of global climate change and its repercussions on the different socio-economic sectors.

Medium-term measures

7. Train of the INE, SENAMHI, AASANA and governmental staff in climate change topics such as information quality, carbon capturing, emissions trading, etc.
8. Train research and private industrial organizations promoting the development of private initiatives for climate change.
9. Strengthen the specialized information exchange mechanisms at the national and international levels.
10. Promote research in the national universities and institutes.
11. Design an electronic information system, discussion networks, and specialized pages at a superior level.
12. Create the Bolivian Global Changes Institute, whose project has been elaborated by the PNCC and is being presented to the university authorities.
13. Create a data bank on climate change in which the bibliographic information is systematized.

Long-term measures

14. National scientific community providing knowledge on climate change nationally and internationally.
- 15 Promote the publication and diffusion of research results in climate changes at a national level.

TRAINING OF POLICY MAKERS

Short-term measures

1. Design of sectoral education plans by authorities in mitigation, adaptation and vulnerability reduction topics.
2. Workshops, seminars and campaigns on climate change aimed at the political party candidates at the local, departmental and national levels.
3. Create technical teams in education, communication and promotion of climate change in each national sector. E.g. In the Ministry of Energy and Hydrocarbons.
4. Train executives of social and private industrial organizations in climate change topics.

Medium-term measures

5. Train local, departmental and national authorities in prioritizing and channeling national resources for the execution of development projects that incorporate climate change topics.
6. Make the authorities at all levels aware of the importance of counting on reliable systematic observation capacities for climate change, so that they make improvements to the data and information acquisition and interpretation systems.
7. Strengthen the specialized information provision systems for the authorities at all levels to keep them informed of the levels of impact, adaptation and mitigation measures and the possibilities of reducing emissions.

Long-term measures

8. Local, departmental and national authorities executing development projects that incorporate climate change considerations.
9. Increase the understanding of and action on global climate change and its repercussions in the fields of responsibility of the authorities.

INCORPORATION INTO THE EDUCATION SYSTEM

Short-term measures

1. Workshops, seminars and campaigns on climate change aimed at the education authorities and consultants for the Education Reform.
2. Incorporate the topic of climate change into the curriculum being designed for the Education Reform
3. Workshops to update understanding of climate change with the environment and natural sciences National Reform consultants
4. Design and elaborate adequate educational material aimed at education for climate change in the formal and alternative system.

Medium-term measures

5. Workshops, course and seminars for education assessors and teachers at all educational levels in climate change topics.
6. Incorporate the topic of climate change into formal education.
7. Incorporate the topic of climate change into university degree and post-graduate courses.
8. Incorporate the topic of climate change into the work training curriculum.
9. Incorporate the topic of climate change into the alternative education curriculum.
10. Strengthen the topic of climate change in the current post-graduate programs in the country

Long-term measures

11. Bolivians respectful of the environment and trained to avoid environmental and climate damage.
12. Bolivians adapted to and active as a response to climate change

CREATION OF SOCIAL AWARENESS

Short-term measures

1. Training courses in climate change for journalists.
2. Workshops and seminars aimed at unions, NGOs, businesses, cooperatives, associations, professional associations, religious groups, civil organizations, etc.
3. Elaborate national audiovisual material to broadcast the causes and levels of impact of climate change.
4. Information diffusion campaigns for the public on the topic of climate change and its effects.

Medium-term measures

5. Workshops and seminars aimed at unions, NGOs, businesses, cooperatives, associations, professional associations, religious groups, civil organizations, etc.
6. Information diffusion campaigns for the public on the topic of climate change and its effects.
7. Promote awareness-raising campaigns by NGOs.
8. Promote the formation of environmental and climatic activists.

Long-term measures

9. Celebrate climate change prevention day in Bolivia with the NGO networks, media, civil organizations, etc.
10. Groups of environmental and climate activists developing daily activities.
11. Community groups, citizen groups, neighborhood boards, etc. working on the prevention of climate change.
12. Oral and printed media actively working against climate change.

Training of Highly Vulnerable Groups and Rescue Groups

Short-term measures

1. Training courses on vulnerability and adaptation to climate change in areas of the country more susceptible to the levels of impact of climate change.
2. Training courses on the direct and indirect effects of climate change for rescue and civil defense groups.
3. Training courses on vulnerability and adaptation to climate change for urban and rural municipality emergency

service workers.

4. Diffusion and training campaigns for the civil population in areas of the country more susceptible to the levels of impact of climate change.

Medium-term measures

5. Design monitoring and interpreting systems of integral data, i.e. as well as traditional variables, incorporate the monitoring of variability and climate change.
6. Workshops and seminars aimed at unions, NGOs, businesses, cooperatives, associations, professional associations, religious groups, civil organizations, etc. in areas of the country more susceptible to the levels of impact of climate change.
7. Carry out specific local and regional studies in topics of vulnerability, adaptation and mitigation in susceptible areas (traditional and new)
8. Coordinate and formulate education policies for adaptation and vulnerability reduction for highly vulnerable groups.
9. Promote the development of local plans for current and future adaptation and vulnerability reduction to the affects of climate change in susceptible areas.
10. Form groups for rapid response to the effects of climate change in highly susceptible areas.

Long-term measures

11. Prepared and working groups for rapid response to the effects of climate change.
12. Areas highly susceptible to the levels of impact of climate change adapted and prepared to minimize their vulnerability to the effects of climate change

EDUCATION IN CLIMATE CHANGE IN DEVELOPMENT

Short-term measures

1. Elaborate plans of action as per PNCC components (where they do not exist) for the incorporation of climate change topics into the development plans and policies of the country.
2. Diffusion campaigns, workshops and seminars for the authorities and functionaries of the different municipal and state units to show the need for and advantages of incorporating mitigation and adaptation to climate change measures.
3. Promote the active participation of the municipalities, vigilance committees, Grass root organizations in climate change

Medium-term measures

4. Demonstrations of the economic advantages of environmental conservation and different mitigation measures.
5. Municipal campaigns to incorporate new technologies into the areas of agriculture, forestry, health, etc., to face the effects of climate change.
6. Incorporate climate change into the sectoral plans of action.
7. Incorporate climate change into the municipal plans of action
8. Promote development projects that respond to the effects of climate change.

7. GOVERNMENTAL MECHANISMS FOR THE APPLICATION OF THE BOLIVIAN NATIONAL CLIMATE CHANGE STRATEGY (BNCCS)

Taking into consideration the measures and priorities identified to generate capacities of adaptation to climate change in the different sectors, mechanisms for its implementation and functioning should also be defined. These mechanisms will serve to generate and shape processes of information, coordination and financing of adaptation measures to climate change in the different sectors and levels of society.

Three principles sectors that would lead to the execution of the BNCCS PLAN, based on these priorities identified.

1. Participation

Adaptation to climate change is the responsibility of individuals, and civil society and government institutions. To generate the participation of the different sectors and levels of society, the PLAN will program the inclusion of the topic of climate change in the different areas of discussion of the government, the NGOs, the scientific community, and the private and public sectors through radio programs, the press and other information and education means established in other complimentary plans of the BNCCS.

2. Scientific research

Vulnerability and adaptation to climate change studies should be carried out in the different sectors vulnerable to climate change with the support of the scientific community and other institutions working on research and extension.

3. Development of wide-reaching, implementation of adaptation measures projects

Adaptation measures to climate change will be implemented as a pilot study to be later replicated around the country with governmental support at first and then more independently but coordinated and facilitated by governmental bodies.

The adaptation measures and the institutional agreements in the different sectors will each be specific (food security, human health, risks and contingencies). This specific nature of the PLAN will be defined within an implementation logic framework with the participation of all interested and involved actors.

However, the PLAN implementation mechanisms will have to also have a global nature to satisfy the three areas determined by the **human security framework** (food security, human health, risks and contingencies).

The basic lines should be structured with the corresponding PLAN measures and activities in mind.

7.1 PLAN Implementation Mechanisms

7.1.1 The National Climate Change Program of the VMENR as the PLAN coordinator

The PNCC, within the framework of the BNCCS process, is understood to be the institution responsible for its execution as well as the activation of the implementation process of the Convention in Bolivia. The PNCC has been the governmental body in charge of carrying out the BNCCS planning process, and so will also be the body in charge of its evaluation and follow-up without becoming involved in the activities of the Ministries, such as those of Health, Agriculture, and Education and/or the Municipal governments.

The BNCCS envisages the PNCC as the body responsible for the fulfillment of the country's obligations to the UNFCCC as this program has been created within the national focal point (the Ministry of Sustainable Development and Planning).

To develop this function, the PNCC will have to have strengthened technical capacities and the capacity to easily include the climate change plans within the existing government structures and other areas of society such as the scientific community and NGOs. The BNCCS and the PLAN see the PNCC and the VMENRFD as articulators of the BNCCS implementation process.

For the PNCC to have strengthened technical capacities, the current structures for generating information and scientific understanding will have to be strengthened along with the scientific community and other levels of society that contribute to scientific knowledge.

The scientific community will play an important role in the search for coherent answers to the country's development, and synergies that will be able to activate the processes of adaptation and mitigation of greenhouse gases as well as gaining experience in including observation and monitoring systems in the political decision-making processes.

On the other hand, the PNCC will explore alternatives to facilitate the adaptation to climate change process. Civil society has, in the last 30 years, gained valuable experience in generating participative processes aimed at action, even when there was not enough scientific certainty. This type of processes can accelerate the adaptation processes if it can manage to include the reduction of risks and adaptation to the levels of impact of climate change in the discussion platforms of civil society and its daily activities.

Finally, the PNCC should play a central role in disseminating information relevant to the levels of impact of climate change to a broad range of actors in society, and so should seek alternative, simple and cheap ways of doing so.

7.2 Intersectoral coordination for the implementation of the PLAN

7.2.1 Intersectoral coordination for the application of the climate change policy in Bolivia

The Interinstitutional Climate Change Council is the main tool for interinstitutional coordination to confer on climate change policy in the country and will have to develop according to the interest the different sectors have in providing this Council with the institutional instruments necessary to coordinate actions among the sectors and levels of society.

7.2.2 Coordination with the implementation of different sustainable development strategies

Adaptation measures to climate change are not completely isolated from productive activities and environmental management. Poor populations tend to be more vulnerable because of the fragility of their economy. In theory, reducing poverty means reducing vulnerability to climate change. The adaptation measures that could be suggested are highly sensitive to the focus of vulnerability analysis, and on the other hand there is a tendency to undervalue the response capacities as only the existing, visible setting of the project is seen and not the expectations the actors may have of the use of a certain resource or the management of a certain region.

Regional development requires integral management of the existing resources, human as well as non-human (biodiversity, energy transformation possibility, logistic resources, scenic beauty, etc.). Maintaining the agricultural biodiversity, for example, is one of the main adaptation measures for responding to global warming. In the same way, the regulation of the use of hydric resources has as many levels of impact on the management of the biodiversity as on possible adaptation measures (e.g. irrigation).

The complication of an adaptation measure is that, so as to be additional to the undertakings to be carried out, it is necessary to revise the suppositions on which the base lines are based (resource management, human development tendencies, infrastructure projects, etc.), which is only possible in theory. In practice, additional support should be sought from the focus on climate change on regional development that is being carried out or is projected for the future. For example, if there is an undertaking to conserve the agricultural biodiversity in a certain region, an adaptation measure should not compromise the conservation of this resource by introducing genetically modified species without the biosecurity and conservation considerations being taken into account.

If during the implementation of the different sustainable development and Agenda 21 conventions the undertakings can be made compatible, the duplication of work and implementation costs can be drastically reduced.

TABLE 3: INTERRELATIONS AMONG DIFFERENT SUSTAINABLE DEVELOPMENT CONVENTIONS TO MITIGATE CLIMATE CHANGE AND GENERATE CAPACITIES TO RESPOND TO ITS LEVELS OF IMPACT

	Climate change	Biodiversity	Wetlands (Ramsar)	Desertification
Climate change		<p>The conservation of areas with high levels of biodiversity such as protected areas and their buffer zones helps the mitigation of climate change</p> <p>The creation of national and regional biological corridors helps to generate technological conversion in agriculture and the forestry sector and therefore reduce greenhouse gas emissions.</p> <p>The conservation of genetic resources can become one of the main adaptation measures in the agricultural and human health sectors.</p>	<p>The conservation of bodies of water and wetlands helps the mitigation of the greenhouse effect.</p> <p>The patterns of change in the use of the soil and consumption increase the impact of climate change on the bodies of water and wetlands</p> <p>Contamination reduction in bodies of water, help adaptation to climate change by reducing additional stress.</p>	<p>Soil conservation can help to fix carbon in the vegetation and the soils.</p>
Biodiversity	<p>The reduction of greenhouse gases in the LULUCF sector can help to improve the quality of the ecosystems.</p>			
Wetlands (Ramsar)	<p>The reduction of greenhouse gases in the bodies of water can help in their conservation.</p>			

	Climate change becomes one of the most important challenges for the management of hydric resources.			
Desertification	Forestation and reforestation activities can help to reduce desertification and recover salinized and eroded soils.			

7.2.3 Coordination with the civil society programs

Civil society has made valuable contributions to satisfying the provision of services for health, education, environment and the fight against poverty. The existing networks have been working with different national activities and make up existing channels to promote adaptation to climate change activities.

Through these existing networks, the national government can arrive to the local actors and generate regional response processes to the levels of impact of climate change. At the same time, through the NGO networks, the implementation of different adaptation measures can be evaluated and applied in other spaces generating response processes.

The PLAN is aimed at working with the NGO networks and national and regional foundations to be able to increase society's understanding of the repercussions of climate change and implement adaptation measures to climate change.

7.2.4 Coordination with the scientific community

The resources for scientific research in the country are limited, however various research institutes both private and public, have found alternative ways of financing their research. Some have set up foundations that work with trusts; others have received financing by linking their research to implementation projects. The coordination with the scientific community will be oriented to reviewing which will be the most likely ways of carrying out scientific research on adaptation to climate change; what type of national potentials can be conducive to this type of research and how much requires the collaboration of the international community.

7.3 The Global Climate Change Adaptation Fund and national actions

Within the negotiations of the UNFCCC there are still various opinions as to how the global adaptation fund should be implemented. A first element of the legal framework of an adaptation fund is given by the UNFCCC in Articles 2 and 4; the former defines a UNFCCC principle to respond to the needs of countries highly vulnerable to climate change and those developing countries that will have to bear an abnormal or disproportionate burden under the terms of the UNFCCC, the latter defines the obligations of the countries in Annexes I and II to help the countries highly vulnerable to the adverse effects of climate change bear the costs implied of adaptation. Article 12 of the Kyoto Protocol defines that a part of the benefits resulting from the reduction of greenhouse gases projects should be used to cover the adaptation costs of countries highly vulnerable to climate change. In relation to this point there is certain unanimity of the G77 countries that the adaptation fund should also receive support from the transactions carried out by other flexibility mechanisms of the Kyoto Protocol.

Even though during the COP 6 the implementation of the **Adaptation Fund** was not defined, some lines can be visualized.

The GEF should be the organism in charge of administering the Adaptation Fund as it has been doing the UNFCCC fund. The setting up of a resources committee has been defined in the COP 6 to define policies for financing sources and existing institutions such as the GEF, the World Bank, the UNDP, the IDB and other multilateral institutions (according to decision 6/CP.7).

At the national level, the participation of national funds and private foundations in financing adaptation to climate change projects during the implementation of the PLAN should be reviewed.

8. BNCCS APPLICATION PHASES

8.1 First Application phase, national capacities strengthening phase

The first phase of the PLAN should be oriented to generating response capacities in society to the levels of impact of climate change. The government will promote measures aimed at broadcasting the topic of climate change in all sectors and levels of society, the PLAN will seek the integration of aspects related to climate change in the sectoral plans and programs as well as the development activities of the municipal governments and the NGOs. To finalize the first phase of the PNCCSS many institutions will be trained to develop on their own actions to reduce the levels of impact of climate change at a sectoral level as well as within local activities and projects.

The PLAN will disseminate the topic within scientific fields so that academic institutions begin to gain experience and develop lines of research and curricular programs to prepare the new generations of professionals and scientists in the

fields of climate change. This is one of the interrelations between the PLAN and the National Education Plan for adaptation to climate change.

The PLAN will also have an influence on the institutional framework that will be set up to finance projects for the adaptation to climate change, whether these are governmental or private foundations. The PLAN will systematize the experiences of adaptation to climate change to define methodologies and lines for financing the adaptation to climate change projects in a way related to the existing methodologies for the mitigation of climate change projects.

Finally, the PLAN in its first implementation phase will seek to coordinate with the implementation of the sustainable development conventions in Bolivia to develop implementation programs that satisfy various aspects of sustainable development in an integral and synergic way.

8.2 Evaluation of the levels of impact of the first phase of implementation and development of the next phases of the PLAN

According to the BNCCS logic framework, the BNCCS will be evaluated five years after its implementation and the plans every two years so the first evaluation will only serve to make corrections and modifications to the logic framework of the PLAN and not to the BNCCS. However, the first evaluation of the PLAN will also serve to integrate within the implementation logic framework actions carried out with other governmental institutions and civil society, and will seek to integrate actions for its implementation along with other national strategies and actions.

The evaluation of the PLAN will also serve to initiate a new consultation process about the success of the methods employed and the gaps that challenge the success of the undertakings.

The PLAN should be defined based on a methodology aimed at refining the capacities for adaptation and not at goals and results, ensuring that this process serves to activating strengths, takes advantage of the opportunities presented by the national and international climate, and gradually reducing the weaknesses and externalize the threats

TABLE 4: PLAN IMPLEMENTATION PHASES

	1st Phase BNCCS (5 years)			2nd Phase BNCCS (5 years)		
	1st	2nd	Eval.	3rd	4th	Eval
Short-term measures						
The topic of climate change has been broadcasted						
Focal groups have been trained in different aspects of the science of climate change						
The topic has been included in different discussion forums of the government, civil						

society, the scientific community and the private settings						
Medium-term measures						
Adaptation measures have been included in the national plans, strategies and policies						
Effective adaptation measures have been implemented at the local and regional levels						
The scientific community has been organized the topic of climate change included in formal research and education programs						
The government has managed to consolidate the mechanisms of information, coordination and financing of adaptation to climate change projects						
Long-term measures						
The institutional, sectoral and intersectoral mechanisms have been consolidated to respond effectively to the levels of impact of climate change						
Research and education programs have been consolidated in universities and research institutes						

9 CONCLUSIONS

- The application of the strategic lines established by the BNCCS is part of a process made up of a group of short, medium and long-term measures.
- Intersectorality, initially represented by the Interinstitutional Climate Change Council and the work with certain public and private units, should be expanded to embrace national organizations.
- Coordinated work among the governmental, civil, productive, and social institutions and the general public, (i.e. All of Bolivian society) is necessary so that the measures of adaptation, vulnerability reduction and mitigation of climate change are carried out.
- Without a doubt, education and communication for climate change will signify important national support to the deeper analysis of the international process of vulnerability reduction, emissions decrease and particularly adaptation to climate change.

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ANNEX No. 1

FOOD SECURITY

Context analysis for the development and inclusion of adaptation measures to climate change in national planning

1. WORLD PANORAMA

1.1. Global and regional setting

When the World Food Summit was held in 1996, over 800 million people were suffering from hunger around the world. For these people hunger is not a transitory state but rather chronic, debilitating and sometimes fatal. This condition is one of the main obstacles to development in the countries where it is found.

Although there has been a more rapid decrease in world hunger since the 1980s, there are still regions where the problem is growing - in Asia and the Pacific mainly due to the number of malnourished people; almost two-thirds (over 500 million) live in this region. In India alone there are more malnourished people (204 million) than in the Sub-Saharan region of Africa.

The problem in Africa is qualitatively different, many African countries, especially in central, southern and West Africa, have not managed to decrease their levels of malnutrition. The number of people suffering from hunger has increased in the last few years; in this region almost half (44%) of the population of 340 million suffer from malnutrition.

Bolivia, along with Honduras, the Dominican Republic and Nicaragua, is one of the countries with the highest rates of malnutrition (23%) in Latin America.

The 1999 FAO report indicates that two out of every five children in developing countries suffer from growth retardation, one out of every three from ponderal insufficiency and one out of every ten from emaciation. The lowest incidence is registered in Latin America and the Caribbean.

Bolivia, after Haiti, has the second highest child mortality rate in Latin America and the Caribbean with rates similar to those of Cameroon and the Democratic Republic of the Congo in central Africa. However, the levels of basic sanitation are within the average for the region. The nutritional pattern of children below 5 years of age in Bolivia is also very similar to the average in the region with a light tendency to show growth retardation similar to some Central American countries.

1.2 Achievements and advances in the world and in the region

The number of people suffering from hunger has decreased from 920 to 800 million in the last 20 years. This is a decrease of over 10% of the population of developing countries. However, the achievements have not been evenly-spread around the world.

In Asia and the Pacific, the incidence of malnutrition has decreased at a good rate meaning that the objective of the World Food Summit to half the number in 1996 of malnourished people has been achieved. In India, the number decreased by 16% during the period 1980-1996, and in other countries such as Cambodia the number decreased by almost 30% in the period 1980-1996.

Nevertheless, in Sub-Sahara Africa the situation has worsened in 26 counties. In countries such as Burundi the percentage of malnourished people has risen by almost 25%. However, 8 countries in West Africa managed to reduce the hunger incidence considerably from 1980 –

1996: Ghana by 50% and other small countries such as Mali, Mauritania and Benin by between 20 –30%.

In Latin America and the Caribbean the pattern is not homogeneous. Some countries have managed to reduce the prevalence of malnutrition quickly, while in others the levels of prevalence, particularly in Central America, have increased. Peru, which along with Bolivia was one of the countries with the highest rate of malnutrition in the region, has managed to reduce the proportion of malnourished population by almost 10% in the period 1980-1996.

1.3 Global food vulnerability

Most of the people who suffer from hunger or malnutrition around the world live in places where the environmental, economic and other factors expose them to a high risk of poverty and food insecurity. At the end of the last century and the beginning of the new, the food security situation became uncertain due to a series of climatic events that are becoming more frequent and intense.

Since the 1980s El Niño has had a heavier impact on the majority of countries in Latin America and the Caribbean. Even though el Niño 1997/1998 did not have the same levels of impact of el Niño 1982/83 around the world, the hurricane “Georges” in the Caribbean and hurricane Mitch, which came out of the Atlantic at the end of 1998, lashed the economies of the majority of Central American countries. In 2000 the middle and Far East the production of cereals was seriously affected, while civil conflicts threatened to increase the prevalence of malnutrition in west and southern Africa. In 2000 floods seriously damaged the harvests in most Asian countries and in 2001 heavy rains affected a great part of South Africa and part of South America.

In 1990, 1994 and 1998 the droughts in the Andean valleys were accompanied by a high increase in child malnutrition. El Niño 1998 spelt drought and disaster for the maize and potato harvests in the Andes, and heavy rains in the Amazon region, all of Peru and part of Ecuador damaged the rice, banana and cotton harvests for exportation (GIEWS (a), 1998).

In 1997/1998 the financial collapse in Asia caused various countries to suffer strong levels of impact on food security particularly in Indonesia, the fourth highest populated country in the world, where the economic crisis coincided with the worst drought in 50 years, and was promptly followed by torrential rains. It is estimated that in one year the number of malnourished people rose from 6 to 12% and maybe to 18%. This would mean that the economic crisis in the Asian countries has added 10 to 20 million people to the ranks of people suffering from hunger around the world (GIEWS (b), 1998).

In 2000 the droughts seriously affected various countries in the near east and south Asia. The reports mention that the average volume of the Tigris and the Euphrates dropped by 20% affecting the irrigation of crops in Iraq, 70% of the cultivated area. In the Gujarat province of India, the worst drought reported in 100 years left 18,000 settlements with serious water problems affecting over 10 million people (GIEWS (a), 2000).

In September 2000 a combination of heavy monsoon rains, tropical storms, typhoons and floods seriously affected countries in south East Asia including China, India, Bangladesh, Nepal, Cambodia, Thailand, Vietnam and Laos. In India floods damaged and destroyed 200,000 hectares of crops, in Cambodia the highest flood levels registered in 70 years destroyed around

250,000 hectares. Another 100,000 hectares of rice were damaged and destroyed in Vietnam, and in Thailand floods damaged and destroyed 645,000 hectares of crops in almost half of the 2,000 sub-districts of the country (GIEWS (b), 2000).

The IFPRI (1999) estimates that 73 million people are added to the world's population each year and in 2020 there will be 7.5 billion people. In rural areas the population will increase by less than 300 million whereas the urban population may duplicate to 3.4 billion by 2020. This tendency may imply great changes in the income and consumption patterns of the population. The same source estimates that the consumption of meat in developing countries may duplicate by 2020 making it necessary to produce more cereals to feed the livestock and likewise the food necessities of the population.

With the beginning of the green revolution of the 1970s, the production of food has been duplicated through irrigation, fertilizers and high-yield varieties. According to databases on cereal production from the US Development Agency (USDA), from 1950 to 1984 the growth in production of cereals exceeded the population growth, increasing from 247 kg. to 342 kg. per person. However, whether this relative success can be repeated remains uncertain. The problems associated with the intensification of production (chemical saturation, soil salinization, erosion and compacting) become increasingly evident. According to the same source, (cit. en Brawn, L. Et al 1998) the production of cereals has suffered a drop of up to 0.5% per year since the 1980s.

The need of the population to satisfy the demand for food could increase the pressure on natural ecosystems and the expansion of agriculture into marginal areas. The IPCC (SAR 1995) avers that agriculture can be maintained at baseline conditions if the concentration of CO₂ is duplicated in the next 50 years. However, a report of the regional levels of impact of climate change (IPCC 1998) shows a concern about the increase in risk of hunger in some regions, particularly in the tropical and sub-tropical zones because of an increase in temperature. It states that at middle and high latitudes there may be an increase in crop productivity whereas in the tropical and subtropical zones where the crops are near to the maximum thermal tolerance there may be a decrease in productivity.

The IPCC prediction can only be understood in the long-term as climatic variability (cyclic climate phenomena in the short-term) in the zones of medium and high latitude have experienced reductions in crop productivity. In 1988 the production of cereals in the US did not cover demand because of heat waves and low rains. In 1995 the crops throughout the northern industrialized countries (the US, Canada, Europe meridional, Ukraine and Russia) were affected by devastating heat waves (Brawn 1996).

The effects of climate change have been seen since the mid 20th century in the global retreat of the glaciers. This situation accelerated at the end of the century in the Andean glaciers, the Alps and the Himalayas. In Asia, the most densely populated region on the planet, if the ice and snow of the Himalayas, the third largest ice deposit in the world, melt then the effects on water availability in the largest part of Asia will be catastrophic. The reduction in ice masses in the Himalayas could affect the hydrology of the most densely populated areas of the world (China, India, Bangladesh and Pakistan). The same would happen in most of the mountain ecosystems around the world.

The rise in sea levels because of a reduction in ice masses (20 to 30cm in the 20th century) could reach 1m. this century. An increase of 1 meter would cost Bangladesh half of its area used

to cultivate rice and, at the same time, would force one million people to emigrate to areas already densely populated. This same situation is the same for all the coastal areas around the world where the most fertile deltas are located.

Now the challenge for world food production is to reverse the tendency to reduce productivity that has been seen since 1990 and to grow a greater quantity of food when the amount of cultivable land per person is drastically reduced, the amount of water for irrigation is decreasing and the response of crops to fertilizers is decreasing.

1.4 International agreements and initiatives

1.4.1 The Rome Declaration on Food Security and the World Food Summit Plan of Action

The Rome Declaration reaffirms the right to alimentation as a fundamental right of each individual. By 2015 the number of undernourished people should have been halved from the level in 1996 of 830 million people.

The World Food Summit Plan of Action is based on seven fundamental commitments:

- we will ensure an enabling political, social, and economic environment designed to create the best conditions for the eradication of poverty and for durable peace, based on full and equal participation of women and men, which is most conducive to achieving sustainable food security for all;
- we will implement policies aimed at eradicating poverty and inequality and improving physical and economic access by all, at all times, to sufficient, nutritionally adequate and safe food and its effective utilization;
- we will pursue participatory and sustainable food, agriculture, fisheries, forestry and rural development policies and practices in high and low potential areas, which are essential to adequate and reliable food supplies at the household, national, regional and global levels, and combat pests, drought and desertification, considering the multifunctional character of agriculture;
- we will strive to ensure that food, agricultural trade and overall trade policies are conducive to fostering food security for all through a fair and market-oriented world trade system;
- we will endeavor to prevent and be prepared for natural disasters and man-made emergencies and to meet transitory and emergency food requirements in ways that encourage recovery, rehabilitation, development and a capacity to satisfy future needs;
- we will promote optimal allocation and use of public and private investments to foster human resources, sustainable food, agriculture, fisheries and forestry systems, and rural development, in high and low potential areas;
- we will implement, monitor, and follow-up this Plan of Action at all levels in cooperation with the international community.

1.4.2 2020 Vision for food, agriculture and the environment

The 2020 Vision for food, agriculture and the environment launched in 1993 has two main objectives:

- (1) Establish and promote a shared point of view and achieve consensus on how to attend to the future global food necessities and, at the same time, reduce poverty and protect the environment and
- (2) Generate information and stimulate the debate to influence the measures taken by national governments, non-governmental organizations, the private sector, industrial development institutions and civil society.

1.4.3 International programs

The Special Program for Food Security (SPFS)

The Special Program for Food Security (SPFS) was born as one of the main FAO strategies to make real the agreements taken on by the world's governments at the World Food Summit. The SPFS is designed to help the Low-Income Food-Deficit countries (LIFDCs) to increase and stabilize food production and productivity as soon as possible and in a sustainable manner. Its fundamental objectives are the generalized adoption of available improved production technologies and improved water management systems, as well as the formulation and application of adequate agricultural policies⁴⁰.

Post-Harvest Action (PhAction)

To ensure the alimentation of humanity in the future, special emphasis should be placed on improving the ways of production and post-production or post-harvest of foods. On the one hand this should increase crop productivity, and on the other improve storage, transport and marketing systems that ensure high quality foods for consumption.

In this context and to assist developing countries, mainly to prevent the loss of millions of tons of cereals, root crops, tuber crops, fruits and vegetables caused by inadequate management and storage, plagues, transport and commercialization problems, the Information Network on Post-harvest Operations - INPhO began to work in 1998.

INPhO is headed by the United Nations' Food and Agriculture Organization (FAO), with the collaboration of the GTZ of Germany and CIRAD of France. The INPhO project is also supported by many other national and international institutions that take care of the post-harvest operations of food crops.

UNDP Global Program for Food Security and Agriculture

The objectives of this program are:

- Supporting the design of the programs and projects in agriculture that are being carried out by the UNDP to achieve sustainable human development.
- Formulating a food security strategy and objectives to assist the regional and country level programming.
- Promoting international cooperation to diagnose and document the location and nature of food insecurity in developing countries.
- Supporting research in agriculture at national, regional and international levels.
- Promoting agro ecological systems at rural, urban and peri-urban levels.
- Promoting information to the UNDP national and regional offices.

⁴⁰ Bolivia is one of the region's LIFDC countries

UN System Network on Rural Development and Food Security

The Network is a mechanism for the application of the World Food Summit whose objective is:

- To obtain support for the efforts carried out by the governments to execute the World Food Summit Plan of Action and the rural development and food security programs
- Reinforce the ties between the Nations' organizations and other interested parties
- Promote synergy and avoid the duplication of efforts
- Exchange and divulge information, experiences and better practices

The network is administered jointly by the FAO and the [International Fund for Agricultural Development](#) (IFAD) in close cooperation with the WFP.

At a national level, the Network is made up of thematic Groups in different priority areas with institutions working on the same themes. These national thematic Groups are supported by a network of interested organizations of the United Nations and international and regional NGOs.

Food Insecurity and Vulnerability Information and Mapping System (FIVIMS)

The FIVIMS is a system or network of systems that gathers analyses and disseminates information on people who suffer from food insecurity or run the risk thereof. The FIVIMS furnishes a framework within which varied activities can be carried out nationally as well as internationally to gather more information to achieve the objectives.

At the national level, a network of information systems gathers and analyses data to measure and monitor food insecurity and vulnerability. These systems are collectively called national FIVIMS.

At the international level the same process happens through a diversified program of activities whose objective is to support the national FIVIMS and set up a data base and network to exchange common information. This is known as the global FIVIMS.

The national FIVIMS is based on the existing national and sub national information systems on food insecurity and vulnerability. It is a system that is managed by the country and aims to satisfy the needs of the users.

At the second FIVIMS Interinstitutional Working Group meeting it was decided that the thematic groups of the Administrative Committee on Coordination (ACC) of the UN System Network on Rural Development and Food Security, a mechanism set up to ensure adequate coordination among organisms for the follow-up of the territory covered by the World Food Summit, would promote the in-country development of the FIVIMS.

1.4.4 Regional projects

Consultative Group on International Agricultural Research (CGIAR)

Various research centers share a mission to contribute to food security and the eradication of poverty in developing countries through research, cooperation, training and support in policy definition. The CGIAR promotes sustainable development of agriculture based on the appropriate management of natural resources.

The CGIAR has been working since 1971 in five priority areas:

- Increasing agricultural productivity
- Protecting the environment
- Saving biodiversity
- Modifying and generating policies
- Strengthening national research

The CGIAR has set up 16 research centers around the world, among which the following are in Bolivia:

- CIAT (International Center for Tropical Agriculture)
- CIFOR (International Center for Forestry Research)
- CIMMYT (International Maize and Wheat Improvement Center)
- CIP (International Potato Center)
- ICRAF (International Centre for Research in Agro forestry)
- ICRISAT (International Crops Research Institute for the Semi-Arid Tropics)
- IFPRI (International Food Policy Research Institute)

2 Food vulnerability in Bolivia

2.2 National settings

2.2.1 Demographic change and development tendencies

According to the predictions of the last National Population and Housing Census 1992, the population of Bolivia will be 13.1 million in 2025 with a growth rate of 2.4% (estimated between 1995 and 2000).

Bolivia is the country with the highest tendency to urbanization in South America even though the level is still low compared to the rest of the region. In 1992, 57% of the population lived in the cities and this rose to 63% in 1996. According to modest estimates, this will rise to 77% in 2025.

Although the largest migratory flows have been from the highland and valley regions towards the plains, some cities such as Cochabamba (valley) and El Alto (highland) have received a great influx keeping the pattern of population distribution to large cities. These cities hold 37% of the country's population and over 66% of the urban population. Another 112 small cities hold between 2,000 and 200,000 inhabitants - 21% of the population.

The urban concentration processes in Bolivia have given rise to a very peculiar network structure. Unlike other Latin American countries where there is a high demographic concentration in the capital city, in Bolivia the largest demographic concentrations are found along the so-called main axis where there are three cities of similar size (La Paz, Cochabamba and Santa Cruz). These cities have grown by 5% per year which means that in 15 years they will have duplicated in size.

However, there is a growth in the cities along the North-South axis where there are 16 intermediary cities of between 20,000 and 200,000 inhabitants with growth of around 8%. In 15 years these cities will have tripled their size. Some grew to five times their original size in the period 1976 - 1992.

The rural areas meanwhile have expelled their population throughout the 20th century. Between 1976 and 1992 the population growth in rural areas was below the natural growth since the rural population grew by just 0.2%. This is seen most in the highland and valley rural areas where the population decreased by 1%.

The urbanization process is accompanied by other processes of demographic change such as improvements in the levels of human development. For example, the fertility rate went from 6.5 children per woman in the 1970s to 4.8 children per woman in 1994 keeping the difference of 2.5 children per woman between the rural and urban areas.

In the levels of education there are also large differences between the rural and urban areas. According to the INE 1996, the illiteracy rate in the cities had reduced to 15% whilst in the rural areas this remained at 30%.

However, at the same time demographic concentration in the cities brings changes in eating habits. In the cities the regional eating habits tend not to be so different. The population has access to other foods such as bread, pastas, sugar and oil, the consumption of which has risen in the last three decades, and canned products, the mass consumption of which has started to become noticed (FAO 1999 (a)).

Population trends in Bolivia

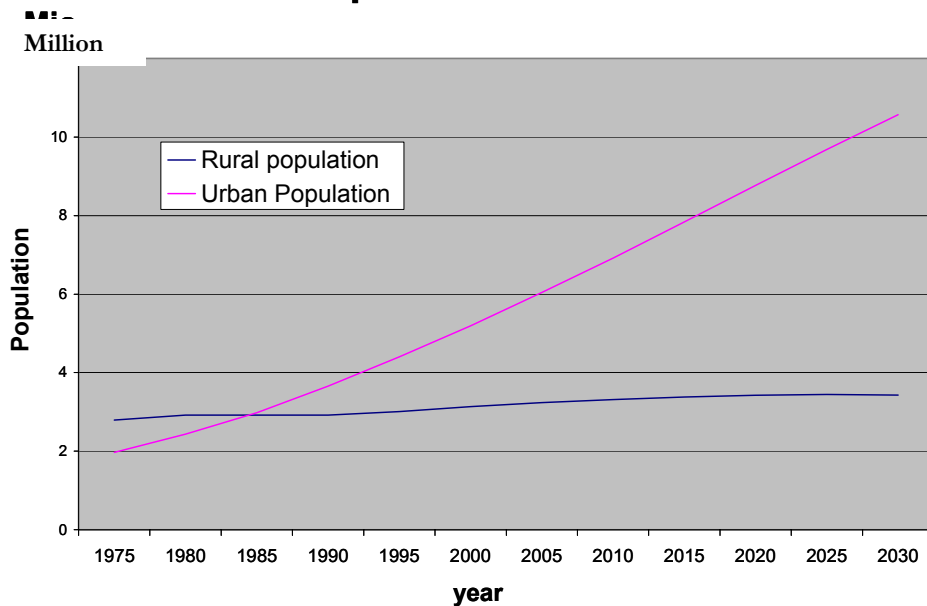


Fig. 2: Projection of the Bolivian population based on FASOSTAT data.

2.2.2 Nutritional situation in Bolivia

The level of food security is characterized by insufficient food production that is compensated for by importing foods and food aid. To the problem of food availability can be added access to food.

The FAO 1999 (b) estimates that the prevalence of malnutrition in Bolivia is moderately high, 23% of the population does not have enough food to satisfy their needs. Even though in the large cities the levels of energy intake are above the level of calorie needs calculated for the Bolivian population of 2085 kcal/pers./day., in the rural areas it is estimated that the level of energy intake is less – one study carried out in the rural area of La Paz shows the level energy intake to be 1590 kcal/pers/day (FAO 1999 (a)).

The Bolivian Nutritional Profile 1999 mentions that the Bolivian diet consists mainly of carbohydrates. In the big cities (the Bolivian Nutritional Profile is based on the Family Budget Survey, which was only carried out in large cities) the main components of the diet are cereals (37% to 44% of the overall calorie uptake), fruits and vegetables, root vegetables and sweeteners, whereas animal products are a small part of the diet.

According to the FAO 1999 (b) in 1995 27% of children below the age of 5 showed signs of undernutrition in Bolivia. However, regional differences are strong. In the highlands and the valleys the prevalence is around 30% and in the plains it is 18% (according to WHO 1995 data quoted in the Bolivian Nutritional Profile 1999).

The Bolivian Nutritional Profile mentions that the most significant prevalence of undernutrition are located within 18 provinces in the departments of Chuquisaca, Potosí and Cochabamba, all of which had high female poverty and illiteracy levels, as well as a lack of infrastructure and basic services.

2.3 National policy priorities

2.3.1 Agricultural strategies and plans

Agricultural Transformation Strategy

The Agricultural Transformation Strategy (ATS) is aimed at promoting economic growth and fighting poverty in the rural areas of the country. It also has the objective of reducing food insecurity and promoting sustainable agriculture that enables, through more efficient use of resources (human, natural, technical and financial), the necessary technology jump to dynamize and modernize agriculture in Bolivia, allowing greater levels of competitiveness and an adequate use of natural resources.

The promotion of sustainable agriculture looks to impulse the potentials of the field (product of the diversity of ecosystems and ecological floors that Bolivia has) and thereby achieve the integral development of the country. The adoption of appropriate technologies that allow the conservation of the rural environment is a fundamental factor of the strategy. Attention is focused on the small farmers and those in extreme poverty, focusing on the rural problematic through education, health, basic infrastructure and productive improvements programs.

The strategy is based on 4 fundamental pillars:

- a) Promote the technology jump in rural areas increasing investment in research and technology transfer in rural areas,
- b) Concentrate public investment in rural areas in human development,
- c) Ensure the sustainable management of the natural resources, and the administration of the land by the INRA, as well as the management of hydric resources,
- d) Increase public investment in roads and irrigation to increase competitiveness in the agriculture sector.

ATS complimentary proposal, new proposal for the Paris consultancy group

Because the ATS had designed a strategic framework but not the institutional and financial mechanisms to ensure the goals, the new proposal for the consultancy group focuses on public investment as a way to achieve a series of measures aimed at promoting micro-credit and access to financing. This strategy defines five areas of action:

- a) Promote a technology jump in rural areas, through the creation of regional agricultural research centers supported by a national co-financing system that uses competitive criteria.
- b) The development of infrastructure of roads and irrigation will be promoted. However, the centralization of works in a governmental institution such as the National Irrigation program has been criticized.
- c) Investment will be made in basic services and social infrastructure (health, education, basic services) with the aim of achieving general coverage. This will be achieved through local governments and based on co-financing.
- d) Investments to ensure the alimentation of the most vulnerable through a food security program will be fomented.
- e) The creation of flexible micro credit systems will be promoted within the general framework of the opportunity pillar of the government strategy 1998-2002 and the fight against poverty.

Important national programs for the climate change policy

Various national programs were evaluated to support the ATS as well as the new agricultural and rural development policy. These national strategies and policies are aimed at satisfying various needs in food production for the country.

The National Irrigation Program was set up to carry out an institutional and legal readjustment in the hydric resources sector and the sub sector of irrigation, and to promote the rational and sustainable use of hydric resources. Other programs under the Ministry of Sustainable Development and Planning and the Ministry of Agriculture, Cattle Breeding and Rural Development are aimed at the management of river basins.

In the 1990s various genetic improvement programs were set up. The National Seed Program has executed various programs for the genetic improvement of potatoes, quinoa, maize, wheat and other cereals, legumes and other fodder crops. Also there have been programs for the

genetic improvement in cattle and fishery development programs at the Bolivian Institute of Agricultural Technology. These programs will start to be carried out nationally through regional foundations in charge of the technology research and transfer within the new Bolivian System of Agricultural Technology. At the same time there will be other initiatives aimed at the protection of genetic resources and cultural and natural heritage in Bolivia that will work in the area of genetic resources from the conservation viewpoint.

Other programs are looking at plague control, such as the Integral Management and Control of Plagues Program and other post-harvest programs aimed at reducing losses during and after harvesting.

Finally, a series of programs and projects have been set up to offer information services on climate variability to producers, as well as other systems to evaluate the achievements of the country related to the reduction of food insecurity.

2.4 Summary of food vulnerability to climate change

To analyze better the problem of food vulnerability in Bolivia we have divided the risk into two. The first is related to the socioeconomic reality of the regions and is directly proportional to poverty, the second is related to the exposure to seasonal risks such as drought or heavy rains that drastically affect the regional economies.

The housing and population census revealed that around 70% of the Bolivian population is below the poverty line. 94% of the people living in rural areas are poor and Bolivia has one of the highest rates of urban poor on the continent (51%). In the rural areas alimentation is based on internal consumption that exposes the homes to a high risk of food insecurity because of variations in farming yields. In the cities problems of employment maintain food security conditions precarious.

The different indexes elaborated⁴¹ to identify the poorest and most vulnerable in the country show that the departments of Potosí, Chuquisaca and Cochabamba are those with the greatest problems of poverty, malnutrition and social vulnerability, and particularly those provinces located in the Interandean dry valleys.

Very general studies show that one of the main causes of social vulnerability and poverty in the region of dry valleys is the environmental deterioration that has been happening since the time of the colony (Montes de Oca, 1998). This is basically a deterioration of the soils because of salinization and erosion, but also because of the seasonal scarcity of water, which seriously limits farming production.

In 1994 the Population Health and Demography Census showed high levels of acute malnutrition in the children of the departments of Chuquisaca (14.6%) and Potosí (10%) due to drought (the national rate is 4.4%).

⁴¹ Whether it be the poverty index, the human development index or the social vulnerability index

From a climate change perspective, the ORSTON has been studying the hydrology of four Andean glaciers in Ecuador, Peru and Bolivia. These studies show evidence of an acceleration of recession of the Andean glaciers since the 1980s (Pouyaud, 1997). In the Quelccaya glacier in the Peruvian Andes there was an acceleration of 3 meters per year between 1970 and 1990 increasing to 30 meters per year since 1990.

The generalized recession of the Andean glaciers may lead to the disappearance of the smallest ones in the next decades with unforeseeable consequences for the mountain ecosystems. Various sources mention that the temperature increase in the mountain regions may increase the volume of water that precipitates as rain and decrease the amount of snow. The result is more water in the rivers during the rainy season and less in the glaciers during the dry season to feed the rivers. This situation could aggravate a seasonal hydric deficit in the dry valleys and increase the food vulnerability in the region as it affects water volume for irrigation and human consumption.

The increase in CO₂ concentrations in the atmosphere would have a fertilizer effect on the crops. It is very probable that the crops at middle and high latitudes could increase their yields, however, in regions where the crops are very close to the maximum temperatures tolerated, there would be a decrease in yield.

The studies carried out in Bolivia show tendencies for crop productivity to increase at middle and high altitudes, whereas on the plains the crops begin to show symptoms of thermal stress. Potato crops show that an increase in temperature has a greater impact on yield than does precipitation (- 20% a +20%) even though a 50% reduction in precipitation means total crop failure. The yields increase with a temperature rise of up to 3°C but after that they begin to show symptoms of hydric stress because of the effects of evapotranspiration. The rise in yields is more evident in the highlands than in the valleys and is strengthened by the increase in CO₂ concentration (MDSP, 2000, page. 212 -213).

In the case of soya, and apparently in rice also (incremental settings), in the plains of Bolivia there is a tendency to reduce crop yields as the temperature rises. The temperature increase would begin to inhibit the growth of the plant due to its using all its energy for water absorption and transpiration. There are favorable effects of the doubling of CO₂ in the atmosphere as soya crops show a high compensation point.

The national studies also show that although the fodder crops would increase their yields due to the effects of climate change, the livestock in the tropical zones would show signs of thermal stress and tend to lose weight.

Studies on the increase in diseases in livestock or changes in plague and disease patterns in crops have not been carried out in Bolivia.

From a viewpoint of contingency, the populations along large rivers are exposed to the risk of suffering flooding, not only in the low-lying areas but also in areas where the channels cannot store any more water, such as is the case of the valleys in the mountain regions. This is clearly related to the capacity of the glaciers to store water as ice.

Another aspect is that of the climatic variability related to the effects of “El Niño” and “La Niña”. In 1998 a follow-up report on the “el Niño” phenomenon produced by the Ministry of Agriculture Cattle Breeding and Rural Development showed evidence of more than a 40% loss of maize and wheat production in the Chuquisaca, Cochabamba and Potosí departments because of drought. The drought also affected potato production in the first strike of 1998, a FAO report showed a reduction in the sowing area. In the same year, when the rainy season began, the government decreed a state of emergency and adopted contingency measures in the plains where the rains were causing floods. This pattern of pronounced droughts in the western area of the country and floods in the lowlands is repeated when the phenomenon of “El Niño” occurs

2.5 The Agenda 21 implementation activities, advances in the management of synergic measures of adaptation to climate change

Various actions in Agenda 21 are directly related to possible adaptation measures to climate change. Some of the obligations of Agenda 21 are structural in nature, such as Chapter 3 of the Fight against Poverty that programs economic, social and environmental development actions. Other obligations are more directly related to possible adaptation measures, especially to some critical themes to do with national vulnerability to climate change.

Chapters 12, 13 and 18 are related to the management of fragile ecosystems, the management and protection of the mountain ecosystems, the fight against soil erosion and desertification, and the preservation of fresh water resources.

The implementation of these chapters of Agenda 21 has cut back the need to establish regulations for water and soil resources. Since 1992, the draft Water Law Intends to regulate water usage activities be it for domestic, industrial or irrigation use, as well as for its management and conservation. Various articles of this Law refer to the management of hydric resources and establish that the government will have to promote integral planning and use, protection and conservation of the hydric resources. This is a necessary basis for the management of the hydric resources, especially in the regions that are showing signs of hydric stress.

With respect to desertification, the government has been promoting and defining the National Desertification Program (PRONALDES) and since 1992 has been preparing the rescue plans for disasters, especially in areas with strong desertification tendencies. The Bolivian government has placed special emphasis on aspects related to desertification in the national curriculum and generating early-warning systems such as the National Early-Warning System (SINSAT) for decision-making at the governmental and private levels. The fight against desertification is in coordination with the hydric management measures mentioned above and forestry management measures proposed in Agenda 21.

In relation to the protection of forestry resources and the promotion of sustainable agriculture, the INRA Law is the basis for a new agricultural system that rationally uses the hydric and land resources.

Finally, the implementation of chapters 15 and 16 is related to the protection of genetic resources and safe use of biotechnology. The National System of Genetic Resources Conservation aims for the active participation of the population in the integral management of

and mutual benefit from genetic resources. Bolivia was one of the first countries to ratify the UNESCO Convention concerning the Protection of Natural and Cultural Heritage. Through measures for the care of genetic resources various germoplasm banks will be set up throughout the country. The role that these banks will play in ensuring species adapted to new climate conditions will have to be evaluated.

3 The scientific discussion of food vulnerability (framework of research into food vulnerability in Bolivia)

3.1 Critical themes in the discussion of world food security and the implementation of food security projects

Global strategies and policies to reduce world hunger

The food security discussion is contained within a wider discussion on how to eliminate world poverty. Currently 1,300 million people are deprived of their basic needs owing to their having an income of less than 1 US\$ per day. Even though the FAO states that there are 800 million undernourished people in the world, the number of people affected by micronutrient deficiency is over 2000 million.

Apparently the lack of political will for food security is linked to the need to invest in other priority areas. The challenge for food security research is to find the key points for fiscal investment to attend to different priorities at the same time.

Gender aspects within the coordination of food security

In the last three decades of the 20th century and with the beginnings of the green revolution, other themes found a space within the scientific discussion on the problem of food security. The role of women in rural communities and families in particular is being researched. Women have a crucial contribution to the wellbeing of the family and the children in particular. Recent studies show that when women reach a certain level of education, the number of children they have decreases considerably.

Aspects related to the functioning of local markets

The capacity of adaptation of the global economies depends on the way in which the local capital and employment markets work. Since the 1970s micro-credit programs have been gaining more success and strength promoting their programs for rural areas and supporting private partners entering to provide raw materials and services to the peasants, as well as helping to create micro and small businesses in rural areas.

Environmental deterioration puts obstacles for food production

Unless the availability of clean water is managed adequately, this will become one of the most important obstacles to food production in the next few decades. The increasing urban demand will leave less water for agricultural use.

Although the green revolution has managed to duplicate global food production in almost three decades, it is less probable that this will be repeated in the next 20; In the last two decades of the 20th century, there was already a drop in soil fertility, especially due to the indiscriminate use of fertilizers and pesticides. The peasants will have to move to marginal and areas less apt for food production, which will increase the pressure on the natural resources.

3.2 *New critical themes in the scientific discussion on world food security*

The globalization processes may bring new disadvantages for poor countries Free trade and economies, integrated international markets, greater freedom in work, information and technology transferal are all part of the accelerating globalization process. There needs to be more research done to show how globalization can be designed and oriented to reduce the poverty levels, improve the food security of the population and promote a sustainable increase in productivity. This research should generate policies that help poor countries to maximize the positive aspects of globalization.

Liberalization may mean that the post-harvest sector stays underdeveloped in some countries Appropriate policies and institutions are required to develop this sector. The research into food policies should describe the causes of the development of the post-harvest sector in some countries and the causes of stagnation or the inexistence of the sector in other countries.

The advances in molecular biology, information, communication and energy can change the way that foods are produced, processed and marketed The use of new technologies gives rise to several questions: What type of regulations do new technologies bring for biological security and food quality? How can rural infrastructure be improved through mobile phones and solar panels? How can the trends towards protection and patenting of biotechnology be reverted to improve the food security of the world population? And how can traditional knowledge and genetic material be protected through the legislation of community rights?

The role of national governments is changing Although the participation of civil society and the private sector is growing in importance in various areas related to food security, the governments still need to ensure the development of rural infrastructure, health, education and the generation of a legal framework. To take advantage of the opportunities presented by liberalization, the governments should efficiently support the adaptation of rural economies to make them more globally competitive.

The urbanization processes will raise the pressure on the need to increase efficiency in the production and distribution of foods It is estimated that by 2025 the urban population in developing countries will have doubled from 2,000 to 4,000 million people, while the rural population will have only grown by 2.7%. The food programs should be aimed at ensuring the alimentation of a growing urban population, particularly ensuring new jobs to reduce urban poverty. The developing countries will have to choose appropriate policies to develop their capacity to store, transport and market their food products, which could increase the income of the rural population and generate employment in the cities.

3.3 Critical themes of food vulnerability and the adaptation of the food production sector to climate change

Basically the question of human vulnerability and adaptation to climate change and food vulnerability in particular arises from the perception that in the future it will be difficult to feed a growing population.

The difficulty of providing food to people may lead certain regions to the brink of social collapse, civil war or the abandoning of certain regions.

*Possible water scarcity **The availability of fresh water may become one of the most important obstacles to the production of foods, aggravated by the levels of impact of climate change, in some regions. There is also a trend towards a growth in industrial and urban water usage, competing with the availability of water for agricultural use. Therefore there is a need for new regulations to establish safe users' rights, as well as to regulate the management of water and give incentives to conserve it.***

The increase in crisis and catastrophe situations (natural as well as economic) requires effective responses to the management of risks and contingencies Globalization as much as the intensification of climatic fluctuations can bring new risks and uncertainties to the agricultural sector and food production. Fortunately there are new ways of managing risks such as the trading of futures to reduce financial risks, and warning systems to predict climate changes that might affect crops.

However, the ways that food production are unaffected by change in microclimates should be reviewed. Research into new species of cereals, tubers and legumes is vitally important.

The challenge for policy research is to generate institutions capable of guiding and assisting agricultural production (early warning, genetic material, plague control, storage), as well as financing and credit security to respond to crisis situations.

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ANNEX No. 2

HUMAN HEALTH VULNERABILITY WHEN PRESENTED WITH THE EFFECTS OF CLIMATE CHANGE CONTEXT ANALYSIS

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HUMAN HEALTH VULNERABILITY WHEN PRESENTED WITH THE EFFECTS OF CLIMATE CHANGE CONTEXT ANALYSIS

I. HEALTH SITUATION

The 20th century was characterized by important advances in life expectancy and improvements in the health situation of the population (particularly the control of infectious diseases), however, the repercussion of poverty, malnutrition and social inequalities on the health indices have also had a significant influence on the increase in health differences between countries with higher or lower levels of development.

Life expectancy around the world has risen from 46 to 66, (an increase of over 40%), becoming without a doubt the greatest achievement in international public health in the last half century. However, in less developed countries three of every four people die before the age of 50⁴².

The aging of the population has become a worrying trend, taking into consideration projections for countries in Latin America and Asia that show increases of over 300% of their population over the age of 65. WHO data indicates that in 1955, 10.5% of the elderly needed help from those working; in 1995 it was 12.3% and will rise to 17.2% in 2025.

The health efforts headed by the WHO have enabled one of the most important health challenges to be achieved: the eradication of smallpox⁴³, however, the initiative to eradicate another six diseases by 2000 (poliomyelitis, leprosy, neonatal tetanus, Chagas disease and iodine deficiency disorders) was only successful in partial eradication of poliomyelitis⁴⁴ or greater control of the rest of the diseases.

I.A. WORLD HEALTH SITUATION

The world health situation is characterized by a decrease in the mortality rate in high risk groups, notable therapeutic advances, the eradication of certain diseases (smallpox and c at a regional level), the development of vaccines and other protection systems, as well as an important technological development in health. Nevertheless, it is also characterized by the appearance of emerging diseases (at least 30 new diseases such as AIDS⁴⁵ and Ebola), the reemergence of diseases previously thought to be controlled, the eruption of infections resistant to antibiotics or the predicted epidemic of diseases caused by smoking⁴⁶.

Among the most frequent causes of death are found infectious and parasitic diseases⁴⁷, the primary causes of death, followed by diseases of the cardio-circulatory apparatus, cancer, perinatal and neonatal causes, respiratory diseases and maternal causes.

⁴² The global life expectancy 50 years ago

⁴³ In 1967 the WHO began a campaign to eradicate smallpox, which included the systematic vaccination of the entire population of endemic countries. In 1980, the WHO Assembly declared the global eradication of the disease, which had cost 313 million dollars over 10 years

⁴⁴ There are continents such as Africa that have yet to eradicate this disease

⁴⁵ 40 million people die of HIV/AIDS per year demonstrating that this disease is a threat to all: children, adolescents and adults

⁴⁶ 3,5 million people die per year from smoking related diseases

⁴⁷ Source: WHO 1997

Table No. 1 MAIN CAUSES OF MORTALITY AT A GLOBAL LEVEL - 1997

1.1 DISEASES		%
1	Infectious and parasitic diseases	33
2	Cardio-circulatory diseases	29
3	Cancer	12
4	Unknown causes	12
5	Perinatal and neonatal causes	7
6	Respiratory Diseases	6
7	Maternal causes	1

Source: WHO

Lower respiratory tract diseases, tuberculosis, diarrhea, malaria and AIDS are the most frequently cited causes of death due to infectious and parasitic diseases, causing 21 million deaths - 10 million being of children below the age of 5.

I.A.1 Health Situation of Prevalent Diseases

I.A.1.1 Situation of infectious and parasitic diseases

- Tetanus is the third cause of death in newborns in many countries, leprosy, which affects 1.2 million people in 70 countries, typhoid fever, which affects around 16 million people and kills over 60,000 each year, and cholera, which currently causes 120,000 deaths each year.
- There are 300 to 500 million new cases of malaria each year and continues to be a daily problem in over 100 countries around the world⁴⁸.
- Tuberculosis, once considered a disease of the past, has come back in such a way as to be considered a global emergency. It was thought that it had been eradicated in many developed countries, living rise to a lack of attention and therefore its reappearance. In the developing countries, this disease kills 2.9 million people each year with a third of cases being attributed to a co infection with HIV.
- Hepatitis B affects 2 million people, 30% of the population is infected with hepatitis C and 170 million people who are carriers run the risk of developing hepatic cirrhosis or liver cancer.

I.A.1.2 Situation of infantile diseases

Infantile diseases have reduced in number and incidence thanks to the efforts of the WHO and UNICEF. The immunization campaigns against diphtheria, tetanus, whooping cough, measles, poliomyelitis and tuberculosis have meant that nine out of ten children are immunized each year. This has decreased child mortality of 134 deaths per one thousand live births in 1970 to 80 in 1995.

⁴⁸ The objective of the WHO regarding this disease consists in reducing the mortality rate from 75 to 20%

The promotion, prevention and treatment of serious infantile diseases such as pneumonia, diarrhea, measles, malaria and malnutrition (contributing to 70% of child deaths around the world) were improved thanks to access to primary health care.

I.A.1.3 Health situation of women

The health situation of women and their well being is especially influenced by their social condition, which is secondary to inadequate health care during pregnancy and labor, sexual abuse during childhood, the risk of sexually transmitted diseases, young motherhood and unsafe abortions.

I.A.1.4 Situation of chronic diseases

The health problems affecting developed countries, and the levels of higher income in developing countries, is raising the cases of cancer⁴⁹, with 10 million new cases being diagnosed in 1995. The cases of diabetes are also on the rise at an estimated 135 million now and 300 million in 2025.

I.A.1.5 Situation of cardiovascular diseases

Cardiovascular diseases are responsible for 20% deaths around the world, approximately 14 million, making it the second cause of death in the developed countries.

I.A.1.6 Situation of workplace diseases

There are 120 million accidents a year and over 220,000 deaths caused by accidents in the workplace.

IB. HEALTH SITUATION IN THE REGION OF THE AMERICAS

In 1998, the population of the Americas made up 13.5% of the global population (800 million people), which will increase by 50 million in 2003. National and international migratory flows are because of the employment situation and have increases strongly over the last few years, putting pressure on the health services of the receiving zones.

There is a marked tendency to urbanization, especially to intermediary cities. The working population makes up 40% to 60% of the region's inhabitants, making an economically active population of (EAP) 399 million in 2000, which will be subject to rising unemployment⁵⁰.

The birth rate dropped from 40/1000 live births in 1960 and 1970 to 19.2/1000 in 1998. The fertility rate also decreased and the tendency of both indexes experienced a strong drop in all the countries so the total population growth will continue to be slow in spite of reductions in mortality.

The number of people below the poverty line increased from 197 million in 1990 to 209 million in 1994; of these people, 65% lived in urban zones even though the proportion of poor people in the rural areas remained larger⁵¹.

⁴⁹Second most frequent cause of mortality in many parts of the world

⁵⁰ The average annual unemployment rate in Latin America and the Caribbean has risen steadily since the end of the 1980s in spite of the recovery of the economy. The impact is more sharply seen on women and young people.

⁵¹ The changes in the structure and composition of the workforce, the drop in family incomes as well as a modification in the family structure have meant that the burden of taking on the responsibility of looking for survival strategies has been taken on by women and children. This situation is reflected in the mass incorporation of women into the informal sector and the precarious insertion of adolescents and children into the workforce.

In the last 10 years the health situation measured by mortality and life expectancy trends in the Americas has continued to improve due to a better social, environmental and cultural context and greater access to technologies, as well as more health services, programs and policies. However, there are still dangerous differences among regions, incomes, educations, sex or ethnic background that are constant and tend to increase from country to country and among different regions in the same country.

There are still diseases related to poverty in some countries, while in other countries diseases of an aged population are increasing. Around 105 million people in the Region do not have regular access to health services, over 2 million women give birth each year without being attended to by a professional, and in 8 countries 40% of the population does not have access to basic health services.

It has also been observed that accessibility to, coverage and availability of medical care reduces when the GDP per capita decreases. Differences according to where a person lives also make an appreciable difference. A baby born in a high-income country has 10 times the possibility of surviving his first year than a child born in a low-income country.

The Region is in a period of demographic transition and presents different mortality rates according to infectious diseases and reemerging diseases, and the increase in chronic and noninfectious diseases.

I.B.1 Mortality

- The mortality indexes have improved over the last 25 years in all age groups in all countries in the Americas, along with a continual increase in life expectancy at birth. However, there are enormous differences between countries and within.
- The percentage of deaths of children below the age of 1 dropped in all countries, especially higher-income countries.
- There was a significant increase in deaths of those over the age of 65 in the low-income countries. The numbers have remained relatively stable in high-income countries and there were average increases in the others.
- The gaps in the mortality rates for children below the age of 1 have remains stable or have closed slightly in the medium-income countries, but remain the same or are increasing in the low-income countries.
- Diarrhea, acute respiratory infections (ARI) and malnutrition are still the main causes of death of children under the age of 5 in most medium and low-income countries in the Region.
- The possibilities reducing mortality due to infectious diseases are high – in countries currently showing poor results, the mortality rate for children below 1 could be reduced by up to 80%.
- Cervical cancer is high in the Region; over 25,000 women die each year.
- Death by violence is responsible for 7% to 25% of all deaths in the countries in the Region and it seems to be on the rise and is reaching epidemic proportions in some countries.

I.B.2 Morbidity

- Since 1991 America has eradicated smallpox and poliomyelitis and has nearly eradicated measles and neonatal tetanus. There has also been a drop in acute diarrhea and a significant reduction in deaths caused by intestinal diseases and acute respiratory infections.
- The immunization programs have reduced the morbidity and mortality rates from immunopreventable diseases. Over 80% of children under the age of 1 are vaccinated against diphtheria, tetanus, typhoid fever, poliomyelitis, measles and tuberculosis.
- Chronic malnutrition has replaced acute malnutrition in childhood and is found along with micronutrient deficiencies mainly in low-income countries. The levels of iron deficiency, anemia and vitamin A deficiency are also found in high levels.
- In the Region new infectious diseases have appeared as well as some thought to have been controlled, and infectious microorganisms which have become resistant to antibiotics, such as cholera which has become endemic in many countries provoking over 1.3 million cases and 11,500 deaths.
- AIDS continues to spread in the Region but at a slower pace than in Africa, Asia and Eastern Europe. All countries now have national programs and monitoring systems.
- Sexually transmitted diseases (STDs) affect between 40 and 50 million people in the Americas each year. The monitoring systems for these are not as well developed as those for HIV/AIDS.
- Malaria has expanded outside its traditional limits and the population at risk has grown. The morbidity rates began a steady rise in the mid-1970s, decreased in 1993 and rose again in 1994 and 1995 until reaching rates twice those registered 20 years ago.
- Dengue has reappeared as an important health risk. The vector, *Aedes aegypti*, is now in all countries of the Region except Bermuda, Canada and Chile, with the 4 serotypes circulating widely throughout the Region.
- The houses infested with *Triatoma* have reduced by 90% in some countries of the Southern Cone, with none in Uruguay, and great advances being made in Chile, Argentina and Brazil.
- Foot and mouth disease has been eradicated in Argentina, Paraguay and Uruguay, and some states of Brazil and Colombia.
- Although infectious diseases are still an important health risk there is a continuing growth in non-infectious diseases as these now account for almost three quarters of the mortality and morbidity rates in Latin America and the Caribbean. The main causes being cardiovascular diseases (45%), cancer (20%), injuries (10%) and diabetes.

I.B.3 Environmental Health

ARIs are most frequent in the rural zones where there is more smoke from burning wood or carbon. Gas is usually used in the urban zones and so the frequency of ARIs is less. Around 60% of ARIs are associated with inside air contamination and other environmental factors.

73% of the Region's population has a household water supply. In the rural areas only 41% of the population and 84% of city dwellers has access to drinking water. 69% of the population has access to sewage services; 80% of the urban population and 40% of the rural population.

Contamination is an increasing problem, especially that from productive activities, the use of fuels and transport, which affects the general population. Contamination caused by agricultural insecticides and heavy metals, which remain in the atmosphere for between 70 and 200 years, is also important.

I.C. NATIONAL HEALTH SITUATION

I.C.1 General background

The Republic of Bolivia, whose territory covers 1,098,581 km², is characterized by its varied geography, altitudes, climates and biodiversities that make up different ecological systems divided into 3 zones: the semi-tropical and tropical plains (60% of the territory), where almost 25% of the population lives, the temperate valleys (15%), where 30% of the population lives, and the highlands and mountain ranges (25%), where 45% of the population lives.

The current population is 8.328.700⁵² and is predominantly urban (58%). The indigenous population is 3.6 million and consists of 36 ethnic groups including the 2 main ones - Quechua and Aymará, who live mainly in the cities of Potosí, Oruro, Sucre, El Alto, La Paz and Cochabamba.

Bolivia achieved positive advances of 32%,⁵³ in life expectancy between 1970 and 1995 and was classified as one of the most progressive countries by the UNDP. However, in spite of having undertaken active state modernization processes generated by the Administrative Decentralisation, and Popular Participation Laws and the Education and health reforms, etc. there are still many problems for which there is no solution. Among these is poverty, which affects 70.5% (incidence or extension of poverty in homes) of Bolivians indicating that over two-thirds of the population is marginalized from the general development of the country⁵⁴.

In 1992, 70% of the 1,322,512 Bolivian homes were considered poor (51% of the urban homes and 94% of the rural) and had no adequate access to basic health, education and housing services; 37% were in poverty (32% extreme poverty, and 5% in impoverishment), 13% were on the poverty line with a minimum level of satisfaction of their basic needs and only 17% could satisfy their basic needs.

The factors previously mentioned have generated internal and external migration on a large scale. Internal migration has two main ways:

- The first, country - city (urbanization), which is a tendency across Latin America. Bolivia has the greatest urbanization in the world with high rates of migration to the main cities of La Paz, Cochabamba and Santa Cruz and medium-size cities mainly in the valleys and plains.
- The second is where people, from the west (Andean Highlands, La Paz, the Yungas region or Alto Beni, and the Chapare region of Cochabamba) move to tropical or semi-tropical zones in the east of the country. External migration has meant that around 3 million Bolivians live in neighboring countries (Argentina, Brazil, Peru, Chile, and Venezuela) or in the Unites States.

The new human settlements in selvatic areas, a product of west/east migration, are generating a notable increase in diseases in a population susceptible due to low levels of natural immunity in their new environments.

⁵² Population and Housing Census (INE 2001)

⁵³ From 46 years in 1970 to 56 in 1995

⁵⁴ Poverty is directly linked to the development pattern of Bolivia, based on the revenue from of natural resources subject to their overexploitation and/or degradation whether renewable or not, due to the pressure put on them by the poor and the consequent reduction of this wealth by their descendents.

I.C.2 National Health System Structure and Organization

I.C.2.1 Health Policies and Plans

Historical background

The General Health Department, the National Department of Hygiene and the Departmental Health Offices were created between 1900 and 1958 as a move towards a National Health System. Decrees were made for school health, industrial health and safety and Regulations for vaccinations: antivariolic, antityphic, anti-yellow-fever, and the fight against diseases: leprosy, malaria, venereal and tuberculosis.

The health transformation, which began in 1950, sought to organize a health system that would respond to the national health situation, incorporating this sector into the National Development Plans and the National Development Strategy.

The chief entity was the Ministry of Employment, Social Security, and Hygiene and Health. Then came the separation into two ministries – the Ministry of Hygiene and Health and the Ministry of Employment, which did not include the social security branch thereby creating the necessity for a National Social Security Fund to be set up, which gave rise to many regulatory problems. In 1958 the Ministry of Public Health was created and the health code approved through a Supreme Decree on the 24 July 1958, which was later replaced by the current Law passed in 1975.

In 1959, the regulations on health workers, the legal exercise of medicine, dentistry and nursing, and the first regulations on medicine and farming and industrial distribution were dictated. The first Health Plan was carried out 1963 - 1965 and was partially based on the whole CENDES, setting out objectives and general guidelines for programming.

In 1978, the International Conference on Primary Health Attention, held in Alma Ata (URSS) approved a declaration in which a declaration was made to define Primary Health Attention (PHS) as the key to achieve Health for All in 2000. This was adopted by the Ministry of Public Health and Social Security.

Since 1980 there has been better coordination between the formal planning and programming phase and the actual execution. Between 1989 and 1993 the Model was based on the following principles: universality, continuity, systematization, unity, opportunity, distribution of logistics, normalization, and integrity. Regionalization was proposed as an administrative-technical mechanism that sought to improve health conditions, defining a geographical space, a population and levels of attention in ever-growing complexity.

Although regionalization and decentralization were mentioned in all the previous Health Models, none effectively incorporated them until the passing of the Administrative Decentralisation Law in 1995, which gave the power to the departmental governments to face the main health problems and others locally.

The Health Model, implemented since 1995, defined the National Health System as a group of public and private institutions regulated by the then National Health Secretary, that carried out health activities based on the Administrative Decentralization Law and the Popular Participation Law implementing a decentralized and participative healthcare model.

In 1998 the Ministry of Public Health and Social Security designed the current health model that was defined as a Universal Access System based on primary healthcare and incorporating gender and interculturality to incorporate attention, management and finances.

I.C.2.2 National Health System Organization

The Bolivian National Health System is made up of the Public Sub sector and the Private Sub sector, to make up the formal part of healthcare.

▪ Public Sub sector

The head of the Health Sector is the Ministry of Health and Social Security (MHSS), which is the branch of the Executive Power in charge of planning and supervising the health and social security actions in the public sector, as well as administering the actions carried out by the private sub sector. The Ministry formulates and executes the national health policies, according to the guidelines of the National Government, designs programs and strategies, and emits and supervises the national health norms.

The Ministry of Public Health generally attends to the rural and outlying populations; it has a relatively wide network of establishments mainly in the rural areas but more complex in the cities. It takes a preventative stance but also cures and rehabilitates mainly in the urban area.

Before the Administrative Decentralisation Law, the Ministry of Health had 11 Health Units in each department and two more chosen according to criteria such as geographical access, population or simply because of social or political pressure, such as those in Riberalta and Tupiza. There are now 9 Health Units, now called Departmental Health Services (DHS) as required by the organization of the departmental governments⁵⁵, which according to the Decentralization Law are regulated by the Ministry of Health (National Health Secretary) and whose budgets depend on the Prefectural Government³¹.

Each DHS is made up of rural and urban Health districts, which are made up of health areas and posts.

▪ Health insurance

Within the public sector are the current Health Funds that replace the Social Security Funds. These are coordinated by the Ministry of Health through one of the Vice Ministries and the Health Insurance Institutes which supervise and regulate.

The Health Insurers attend to salaried workers organized through the financial schemes of the Social Security, however pensions are separate. There are eight specially regulated Health Funds and two integral insurances of which the National Health Fund is the most important giving 85% of coverage to this type of insurance. In the last few years it opened to independent workers but not to other sectors such as peasants, domestic workers, etc.

▪ Private Sub sector

This is made up of businesses and individuals, formal and informal, for profit or not-for-profit or with financing and private administration.

- The private for profit services include health care, materials, support and diagnostic services and medicines. Although there is a high opinion of the efficiency of this sub sector, it only covers 10% of the population.
- The private not-for-profit services are made up by the Church and NGOs⁵⁶ whose presence depends on a source of funding, the level of poverty in the zone, the degree of coordination with the municipalities, etc. Generally those that count on international financing are in areas of

⁵⁵ Administrative Decentralisation Law

⁵⁶ 94 of which work in health

extreme poverty, whereas those that have national funding are located in periurban zones and poor and rich neighborhoods.

The Church, mainly the Catholic Church, usually works in zones of extreme poverty generally with state human resources, its own infrastructure and shares the costs with the population it serves. In some departments such as Cochabamba they are organized in networks according to the complexity of the services offered.

- The providers of traditional medicine such as herb doctors, midwives and traditional healers are slowly being incorporated into the formal healthcare system, mainly the midwives. Some have organized the Bolivian Society of Traditional Medicine where their establishments are accepted in some areas of the country. It should be noted that this type of medicine is accepted more in some areas than in others.

I.C.2.3 Healthcare Services Network

The healthcare network is made up of a network of services locally administered and alongside the community, the municipal government and the departmental government, technically and legally regulated by the Ministry of Public Health and Social Services. The Demographic and Health Study has shown that the public sub sector really only attends to 40% of the Bolivian population.

▪ Public Services

The public sub sector has a hierarchy of services according to the complexity of attention:

The First Level is made up of 1,201 health posts and 896 health centers with 2,276 beds for normal deliveries and emergencies. It develops basic preventative, curative and educational activities as well as integrating some traditional medicine. It is currently forming a wide network in the rural and periurban areas.

The Second Level is made up of 63 district hospitals with 1,717 beds to attend to basic interventions and care in the 4 specialties, General Surgery, Pediatrics, General Medicine and Gynecology-Obstetrics. These are usually found in intermediary cities or large towns.

The Third Level has 81 general hospitals offering specialized attention in neurosurgery, ENT, etc. there are 5,277 beds, 29 specialist hospitals with 2,071 beds including the health insurance hospitals and the psychiatric hospitals. These services are mainly located in major cities or the capital cities of each department.

The system has mainly two administration systems:

- a) Sectoral or administrative, related to the definition and administration of policies, plans and programs for healthcare services.
- b) Shared, common responsibility at the local level to administrate the health services in a determined municipality.

▪ Health services insurance

Health consultations are carried out in the polyclinics where there is a large number of doctors working during the day, and hospitals where there is various specialized equipment (PET scans and MRIs, etc.). There are 9,300 staff and covers mainly the urban population, reaching only 4% of the rural population.

I.C.2.4 Health Infrastructure

The Popular Participation Law passed in April 1994 transferred to the municipal governments the property rights of goods and assets of the health establishments. This is made up of the second and third level hospitals, district hospitals, health centers and posts. There are 2,128 health establishments of which 1,788 belong to the Ministry of Health and 236 that belong to the Health Insurers³².

I.C.3 Specific Health Problems

I.C.3.1 Child Health

The child mortality rate went from 99 per 1,000 live births in 1984-1989 to 75 per 1,000 in 1990-1994 (ENDSA 94). Child mortality in the rural zone was 92 per 1,000 live births and 60 per 1,000 in the urban areas. Between 1984 and 1989 these rates were 120 and 80 respectively. The highest rates are found in the valleys (101 per 1,000 live births), in the highlands the rate was 96 per 1,000 live births and in the plains 53 per 1,000.

The neonatal mortality rate was 41 per 1,000 live births and postnatal 34 per 1,000. Mortality in the 1-4 year-old group dropped from 57 to 44 per 1,000 in the period 1990-1994. Childhood mortality was 116 per 1,000 in the same period.

28% of the children below the age of 3³³ are chronically malnourished (short for age); this percentage was 10 points less than shown on the ENSDA 89. Chronic malnutrition per region shows indices of 32% in the highlands, 30% in the valleys; and 18% in the plains.

Iodine deficiency disorders were measured in a study on goiter in 1983 which found that 65.3% of the population was affected. In 1989 a second survey applying the same index found that the rate had decreased by 20%.

I.C.3.2 Adolescent Health

The specific fertility rates have dropped over the last 30 years in all age groups except that of 15-19 years, which remained the same but increasing the average for all age groups throughout the country. In 2000 13% of babies were born to adolescent couples.

Only 5.7% of adolescent women use contraceptives. Health care for adolescents is insufficient, especially in the topic of sexual and reproductive health.

I.C.3.3 Adult Health

Fertility dropped by 26% in the last 5 years³⁴; according to current reproductive levels, women will have an average of 4.8 children rather than 6.5 – the average in the 1970s.

Knowledge about contraception methods is scarce. In 1994 three out of four women had heard of modern contraceptive methods in contrast with two out of three in 1989. Where there is a higher degree of education there is more knowledge and use of contraceptives, it is greater in urban zones also.

The ENSDA 94 indicated that the average maternal mortality had remained constant: 416 deaths per 100,000 live births in 1984-1989 and 390 in 1990-1994. The rate was highest in the highlands at 602 per 100,000 live births, more than double that of the valleys (293) and almost three times higher than that of the plains (110).

Only half of the women are vaccinated against tetanus; 60% in the plains where there is greater coverage. There is a high number of homebirths (57%), 40% of which receive no professional attention. The causes of maternal death are (in order of importance): hemorrhage, toxemia, infection and obstructed labor. Abortion accounts for an estimated 27% to 35%.

The 1992 census found that 6.1% of the population was over the age of 60. Many were still working and the mortality rate estimated in those above the age of 65 was 7.8 per 100,000 inhabitants (8.2 in men and 7.4 in women).

I.C.3.4 Indigenous people's Health

There are three main indigenous groups³⁵: Aymarás, Quechuas and Guaraníes, and 35 ethnic groups each with their own cultural identity. It is estimated that nine ethnic groups were extinguished in the 20th century.

These populations are highly exposed and more vulnerable to infectious diseases. The incidence of tuberculosis in these groups is 5 to 8 times higher than the rest of the Bolivian population; cholera kills the Matados and the Guaraníes.

Gastrointestinal infections, especially acute diarrhea, are the main cause of death in infants and children below the age of 5. These infections are more frequent and receive less medical attention. The immunopreventable diseases, especially neonatal tetanus and measles, strike indigenous children who receive less immunization than the children in the urban zones.

The high number of unspaced pregnancies and the young age at which they begin breastfeeding during a great part of their lives, the lack of professional help at childbirth and the lack of family planning significantly increase the early death of the indigenous woman.

I.C.4 Mortality

The health situation of the women, mainly those in their childbearing years and those below the age of 5 is one of the most serious health problems in Bolivia, it is very important to reduce the high maternal and child mortality rates.

In 1993, the main causes of hospital death were circulatory apparatus disease (27%), digestive system diseases (14%), respiratory tract diseases (7%), cerebrovascular disease (4%), urinary tract diseases (3.5%), certain conditions arising in the perinatal period (3%), injuries (2.5%), malignant tumors (1.5%), tuberculosis (0.6%) and endocrine gland and metabolic diseases and immunity disorders (0.6%).

I.C.5 Epidemiological Profile

The social organization systems are different in the three geographical regions of the country (highlands, valleys and plains) so the Bolivian Epidemiological Profile³⁶ shows a predominance of health problems unleashed or favored by environmental and socio-economic factors (poverty, lack of education, little access to health services, etc.) shown by the proliferation of diseases related to the water, air, soil and unhealthy atmosphere, which favor the development of infections.

The epidemiological profile is in a transitional stage, it is characterized by parasitic diseases or immunopreventable infections in remission, associated with increasing chronic and/or degenerative pathologies (cancer, cardio pathologies, Chronic Obstructive Bronchopulmonary Disease, etc.), as causes of death.

I.C.5.1 Diseases Transmitted by Vectors

Malaria is on the increase, in 1987 24,891 cases were registered and in 1996, 64,135 cases were registered in 8 of the 9 departments, 6 of which are high-risk zones, showing that the number of cases tripled in 9 years.

Malaria has reappeared in wide areas where there had been no transmission and outbreaks appeared where traditionally, due to geographical characteristics, there had never been this problem. The *plasmodium falciparum* infections are reported to be resistant to the usual medication making it necessary to prescribe more complicated and expensive medicines. There is 15% to 45% resistance to chloroquine, mainly in Riberalta and Guayaramerín in the Beni and part of the Pando. In 1996 there were 14 deaths from malaria reported in hospitals.

Chagas disease is important in the country as this vectoral transmission is found in 63% of the national territory, and it is estimated that approximately 1.2 million people are infected with *Trypanosoma Cruzi*. It is also estimated that there is a general seroprevalence of 40% that rises to 70% in some zones.

Leishmaniasis is one of the priority health problems due to its being on the increase. The incidence rate in 1996 in the country was 30.4/100,000 inhabitants⁵⁷. It is found in the tropical and subtropical zones of the Departments of Pando, Beni, Santa Cruz, Cochabamba and La Paz.

Dengue has reemerged in the country with cases being presented in Santa Cruz and the vector being detected in the Department of Pando. There are also cases of yellow fever and sporadic outbreaks of hemorrhagic fever and the plague.

I.C.5.2 Immunopreventable Diseases

In 1998 the last case of confirmed Poliomyelitis was reported. In 1992 there was an important outbreak of measles, which was followed by an increase in vaccinations and a reduction in cases. In general there is a decrease in immunopreventable diseases in the country due to good coverage of vaccinations.

I.C.5.3 Chronic Infectious Diseases

Tuberculosis is highly prevalent in Bolivia. The number of cases has risen in the last few years with 10,012 cases registered in 1996; this disease is without a doubt one that needs more control at the national level.

Leprosy is found in the rural zones of Beni, Pando, Santa Cruz, Cochabamba, Chuquisaca, Tarija and La Paz. In 1996 5 cases per 100,000 inhabitants were detected.

I.C.6 Health Policies Strategies

The Ministry of Health and Social Security is promoting the Strategic Health Plan (SHP), which is based within the "Fight against Poverty" development model and the "Globalization and Health" health model based on the principles of social responsibility, the commitment to Bolivia and the strategic alliance with the Bolivians and finally social ethics.

The SHP has five components:

⁵⁷ National Leishmaniasis Program 1997

- Priority national programs such as the Mother-Child Program, the Reproductive Health Program, the Expanded Immunization Program, the Fight against Chagas Disease Program, the Fight against Malaria Program, etc.
- Strengthening and expansion of health insurance, which modifies the Mother-Child Insurance, generating the current Basic Health Insurance that covers the other members of the family and is an important means of improving access to health services
- Bolivian Epidemiologic Shield, which is the main strategy of the fight against vectoral and non-vectoral diseases endemic in the country
- A health model with multiple services, which fulfills the demand
- Family medicine

II. VULNERABILITY AND ADAPTATION OF HUMAN HEALTH FACED BY CLIMATE CHANGE

One of the most serious environmental problems that we currently face is global climate change with its dangerous repercussions on human security and health in particular. The effects can be either direct or indirect depending on how long the change makes its effects felt.

II.A DIRECT AND INDIRECT EFFECTS OF CLIMATE CHANGE

The variations in climatological patterns favor the emergence of diseases that were under control or had disappeared (cholera), or the endemic areas extend beyond their traditional boundaries.

Human health may directly suffer the effects of global climate change as an immediate result of the climatological phenomena such as the damage caused to the physical integrity of people or epidemics generated by landslides, cyclones, droughts, floods, etc. or the effects may be felt indirectly such as with the increase in the incidence and prevalence in diseases transmitted by vectors, reemerging diseases previously controlled or eradicated, the development of new diseases, etc.

The following effects appear to a greater or lesser degree:

- An increase in the morbidity or mortality rates.
- An increase in infectious diseases mainly related to those transmitted by vectors.
- An increase in the malnutrition and dehydration indexes due to lack of availability of food and water.
- Damage to the public health infrastructure because of climate change.

The impact will have different consequences on the different geographical zones where the climatological parameters: temperature, rain precipitation, humidity, wind speed, UV radiation, etc., will make up its different scenario bringing different consequences for human health and its related factors.

The area where a certain population lives make, for example, sensitivity to extreme temperatures very varied and depends on the latitude and the average temperatures of the zone. In a region of higher impact of morbimortality the temperature may register at 25° C while in another the impact may not be measured below 39° C.

Diseases transmitted by vectors are favored by changes in the climatological patterns since the variation of these conditions generates suitable climates for the vectoral development, increasing reproductive possibilities, decreasing incubation periods and its efficacy.

Germs transmitted by vectors, due to their short lifespan and dependence on the climatological parameters, may display a marked tendency to increase their transmission for example when there is a temperature increase and other climatological changes. One example of this was dengue in Mexico, where researchers found that the average temperature in the rainy season was the strongest indicator for the dengue infection in the population. Reinforcing this observation laboratory studies found that the incubation period for dengue dropped from 12 days at 30° C to 7 days between 32° and 25° C (Watts et al 1987). This 5 day decrease could potentially triple the percentage of viral disease transmission to humans.

The different cyclical meteorological phenomena such as “El Niño” also exert a notable influence on human health, whether during the years when it appears or in later years, such as the case of dengue.

II.B THE “EL NIÑO” PHENOMENON

This cyclic phenomenon appears in two to seven year cycles and is characterized by the appearance of warm currents off the shores of the Pacific Ocean in South America in summer. The rise in temperature of the surface waters was recognized by Peruvian fishermen who named it “El Niño” (The Child) as it began near Christmas.

The phenomenon begins near Australia and Indonesia with a temperature rise of 4 to 8°C producing currents that move eastwards reaching the coasts of South America approximately six months later. The movement of the waters is related to the cooling of the western Pacific near Asia.

The interaction of the layers of air cause changes in the rain patterns causing floods and droughts, as well as variations in the hydric resources, agriculture, and many social and economic activities.

The mechanisms of “El Niño” are made up of dynamic and thermodynamic interactions between the atmosphere, the oceans and the earth’s surfaces. It usually lasts for 12 to 18 months. The most intense periods were in the periods 1940-1941, 1982-1983 (the most intense of that century), 1986-1987, and 1990-1994 (the longest). The main area of the phenomenon is the Equatorial Pacific; however, other regions are affected in different ways. There is severe damage done to the road and services infrastructure, water supplies, flooding, destruction of houses and an increase in diseases transmitted by vectors and contamination of waters and foods.

Between episodes of “El Niño” another phenomenon arises characterized by low marine temperatures that causes opposite atmospheric situations, mainly in winter. This is called “La Niña” or “El Viejo”.

II.B.1 Impact of the El Niño phenomenon on health

At the same time as the “El Niño” cycles in America, there are outbreaks of diseases linked to *V. cholerae*, *Campylobacter*, *G. botulinum*, *E. coli*, *Salmonella*, shigellosis, hepatitis A, Malaria, Dengue, Leptospirosis, Leishmaniasis, Encephalitis, among others.

It is thought that the cholera epidemic in Peru in January 1991 was related to El Niño⁴⁹. Cholera as an emerging disease in the Americas caused, between January 1991 to the middle of 1997, more than 1,300,000 cases and over 12,000 deaths. Its peak coincided with the last cycle of El Niño, mainly along the coastlines of the Pacific.

The reemergence of malaria and dengue in the 1980s and the beginning of the 1990s with the introduction of Dengue 3, the increase of hemorrhagic dengue and the appearance of *Aedes albopictus*, as a new vector, coincide with large climatic variations, floods, political-social upheavals

in various countries with important movements of population as refugees, displaced and migratory workforce to zones with greater economic and social development.

The Hantaviruses are zoonoses that are transmitted by rats and mice through excretory aerosols. There is a global spread and since 1993 they have affected several countries in the Americas (the United States, Canada, Brazil, Paraguay, Uruguay, Argentina and Chile) causing highly lethal pulmonary and renal syndromes.

II.B.2 Frequent pathologies presenting at the same time as El Niño

- **Flood areas:** Acute respiratory infection, acute diarrhea diseases, diseases transmitted by vectors (dengue, malaria, equine encephalitis, leishmaniasis), contagious water and food-borne diseases (cholera, salmonella, shigellosis, viral hepatitis, intestinal parasites, leptospirosis), skin diseases (scabies, bacterial infections and mycosis). Bites from snakes or rodents usually increase also.
- **Drought areas:** Diseases transmitted by vectors, skin diseases, diarrhea, dehydration, risks from elevated atmospheric temperatures, sunburn, an increase in secondary symptoms in people with cardiovascular or respiratory diseases.
- **Avalanches and landslide areas:** Drowning and multiple traumas, flooding, landslides, destruction of homes, damage to road health and agriculture infrastructure, all of which have repercussions on health.

II.C NEW, EMERGING AND REEMERGING DISEASES

Despite the important success of eradicating smallpox⁵⁸, some of the epidemics most damaging to humans have reappeared in the last few decades, such as: cholera, malaria, tuberculosis⁵⁹ or yellow fever at the same time as new diseases have appeared:⁵⁹ such as AIDS, Ebola, etc., that have stretched modern epidemiology and highlight, among other factors, the possible role of climate change in the generation or exacerbation of these diseases⁶⁰.

The range of infectious diseases is changing rapidly because of climate change and other environmental variations⁶¹ and in the population⁵¹, where the processes of urbanization, the growth of poverty, informality, demographic changes and unhealthy lifestyles that cause overcrowding in neighborhoods with a high rate of social exclusion, inadequate housing and settlements in inadequate zones are clearly factors.

Other reasons are:

- The proliferation of arthropods and rodents in rural and suburban areas,
- Deficiencies in basic sanitation,
- War generating refugees and displaced people,
- Insufficient financial resources and sanitary infrastructure to attend to risk and emergency situations as a result of the appearance or rise in cases of infectious diseases,
- Epidemiological monitoring, diagnostic and health communication systems with different degrees of development that make difficult the timely knowledge of the evolution of the survival mechanisms of pathogenic microorganisms,

⁵⁸ Declared eradicated in 1980

⁵⁹ At least 30 in the last 20 years

⁶⁰ The WHO estimates that there were at least 333 million new cases registered in 1995

⁶¹ Climate change, reforestation, increase in UV radiation, air, water and soil contamination, the indiscriminate use of plaguicides

- The facility and speed of domestic and international travel,
- The growing movement of animals and animal produce,
- The growing resistance to the antimicrobial agents that continues to reduce the effect of medicines, increases suffering, unnecessary mortality as well as healthcare costs.

II.C.1 Definitions

The group of communicable and infectious diseases of great concern is currently described as “new, emerging and reemerging diseases” with the following definitions:

- **New diseases:** are those that are first described as: the human immune deficiency virus (HIV), the Ebola virus and other retroviruses, arena virus, Hantavirus and new species of Microsporidium, etc.
- **Emerging diseases:** are those whose incidence has risen in the last few decades (dengue, cholera, etc.). these are pathogens known to cause cholera, dengue, yellow fever, plague, that have reappeared and are causing or have caused severe epidemics such as the cholera epidemic in 1991 (Peru, Bolivia, Argentina).
- **Reemerging diseases:** are those that reappear after a significant drop in incidence (malaria, tuberculosis, plague, etc.). The mutation of the microorganisms that lead to the increase in spores of Mycobacterium tuberculosis, enterobacteria, Staphylococcus, pneumococcus, gonococcus, malaria parasites, and other pathogens that are resistant to one or more medicines and generate high costs for alternative medicines that are not always available to the health services.

These diseases are not limited to any certain region in the world, nor to the developed countries or developing countries and so they are a general threat that demands a coordinated response from the health systems around the world. There is also an obligatory financial burden for prevention, control of epidemic outbreaks and healthcare of the sick.

DATE OF APPEARANCE OF EMERGING AND REEMERGING DISEASES

<p>1973: Rotavirus, important cause of infant diarrhea around the world</p> <p>1976: Cryptosporidium parvum, parasite that causes acute and chronic diarrhea</p> <p>1977: Legionella pneumophila, causes legionnaire’s disease, can be fatal</p> <p>1977: Ebola Virus, causes hemorrhagic fever, 80% fatal</p> <p>1977: Hanta Virus causes hemorrhagic fever with renal syndrome. Highly lethal</p> <p>1977: Campylobacter jejuni, bacteria that causes diarrhea</p> <p>1980: Human T-Lymphotropic Virus Type Y (HTLV-Y), causes lymphoma and leucemia</p> <p>1982: Escherichia coli 0157:H7, spore that causes bloody diarrhea</p> <p>1982: Human T-Lymphotropic Virus Type 2 (HTLV-2), causes tricoleucemia</p> <p>1983: Helicobacter pylori, bacteria linked to gastric cancer and peptic gastro duodenal disease</p> <p>1983: Human Immune Deficiency Virus (HIV), causes AIDS</p> <p>1988: Hepatitis E Virus, causes epidemics in warm climates</p> <p>1988: HerSHP Human type 6 Virus, causes fever and exanthema</p> <p>1989: Hepatitis C Virus, causes liver cancer and hepatopías</p>
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1991: Guanarito Virus, causes Venezuelan hemorrhagic fever
1992: Vibrio cholerae 0139, causes epidemic cholera
1994: Sabía Virus, causes hemorrhagic fever in Brazil
1995. HerSHP Human type 8 Virus, associated with Kaposi sarcoma in AIDS patients
source: WHO

II.C.2 Description of some important Diseases

II.C.2.1 Human Immune Deficiency Virus/Acquired Immune Deficiency Syndrome (HIV/AIDS)

This is now a global pandemic. Currently in Latin America and the Caribbean there is thought to be more than 1.5 million people infected with HIV and the cost of attending to AIDS patients is over US\$2,000 million.

The notable impact of HIV/AIDS on public health is largely due to the multiple opportunist infections that present in the course of the disease. Information from Brazil, Honduras and Mexico shows that tuberculosis is the most common affecting over 330,000 people in the Region in 1992. The co infection of HIV and M. tuberculosis increases notably the number of people with active pulmonary disease and, as a consequence, increases the risk of infecting others with or without immunodepression. To these can be added the many people who harbor spores highly resistant to the main drugs that can be used for treatment.

It is known that HIV and human papillomavirus (HPV) influences the susceptibility to various types of cervical and uterine cancer.

II.C.2.2 Tuberculosis

The statistics show that a third of the world's population is infected, of whom 7.8 million have the active disease. It caused the death of 3 million people in 1997, 50% were not treated.

The World Health Assembly in 1991 reported the advance of tuberculosis, declaring tuberculosis to be a global emergency two years later. The WHO and its member countries reinforced their commitments through the elaboration of new strategies to detect, diagnose, follow up and treat, with the aim of controlling the advance of this disease by creating the DOTS "directly observed treatment strategy, short course".

II.C.2.3 Cholera

This disease reappeared as an epidemic in the Region of the Americas in 1991, producing over one million cases and around 10,000 deaths. The sea exports from Peru were embargoed and there was a decrease in tourism that cost the country approximately 770 million dollars in just one year.

There has been a decrease in cases reported in some countries after outbreaks in Brazil, Argentina and Central America. The PAHO estimates that to control cholera in the Region of the Americas would cost over US\$ 200,000 million and a decade of improving water supplies, food control, and improved sewage disposal systems, and the development of healthy hygiene practices.

II.C.2.4 Dengue

Dengue has increased 60 times more in the Region, producing multiple epidemic outbreaks. The vector *Aedes aegypti*, after a notable decrease in the 1950s and 1960s has returned throughout most countries in the continent. *Aedes albopictus* has returned to the region increasing the risk of spread of the disease. Both have meant that in 1995 there were cases of hemorrhagic dengue in 15 countries, forcing expensive emergency measures to be taken.

The South American arena virus has appeared in new areas of farming and forestry exploitation. Since 1956 when cases of viruses transmitted by rodents began to be registered, there has been at least every three years a new member added to the group. Some are not pathogenic for humans but five cause diseases and three cause important health problems: in Argentina (Junin Virus, causes Argentinean hemorrhagic fever); in Bolivia (Machupo Virus causes Bolivian hemorrhagic fever); and Venezuela (Guaranito Virus, causes Venezuelan hemorrhagic fever).

II.C.2. 5 Yellow fever

Affects five countries in Tropical America with its axis in the Amazon region where there are periodic outbreaks in populations living in woodland areas where the disease is enzootic among the monkeys. In 1996, tourists who had traveled without the vaccination returned home to the United States and Switzerland bringing yellow fever.

II.C.2.6 Cryptosporidiosis

Vulnerability to emerging infections is not limited to developing countries. In 1993, the US had a serious outbreak of Cryptosporidiosis due to the contamination of a water supply with *Cryptosporidium*, an intestinal parasite that causes prolonged bouts of diarrhea in immunocompetent people and serious effects, potentially fatal, in people who are immunodepressed.

II.C.2.7 Hantavirus Pulmonary Syndrome

In the region bordering the States of Arizona, Colorado, New Mexico and Utah a new virus was identified as the cause of the Hantavirus Pulmonary Syndrome, which comes from the exposure to infected rodents. The mortality rate is high, around 50%. There have been over 100 cases in 22 states of the US. In Canada there were 7 reported. Cases have also been reported in Argentina, Brazil and Paraguay.

II.C.2.8 Leptospirosis

This is endemic in the countries of the Americas, however, periodically there are epidemic outbreaks, mainly after floods. The presence of infected rodents, as well as dogs, pigs, cattle as harborers, are a problem. In Nicaragua there was a regular outbreak caused by hurricane flooding in the second half of 1995. There have also been cases in Costa Rica and Honduras, in small pockets.

II.C.2.9 Malaria

Between 1955 and 1969, the WHO carried out a campaign to globally eradicate malaria, and was successful in areas previously affected and all the developed countries. However, in 1997, it was reported that 90% of the endemic countries were looking for new strategies to combat malaria and in 1996 approximately 10,000 cases of malaria were reported within the EC.

II.C.2.10 Ebola Hemorrhagic Fever

This is part of a group of diseases produced by a virus known as African Hemorrhagic Fever and Marburg Disease. They are members of the Filoviridae group. The two viruses, Ebola and Marburg, are different and are not related to any other known infectious agents.

Ebola⁶² was identified in Sudan and Zaire in 1976, with a second outbreak in 1979. In the first outbreak there were 70 cases and 33 deaths; and in the second, 229 cases and 117 deaths in Sudan, and 237 cases and 211 deaths in Zaire. The WHO in 1995 proved that the Ebola virus was responsible for the epidemic of hemorrhagic fever in Zaire, which caused almost one hundred deaths.

II.D PHARMACORESISTANCE

Antimicrobial pharmacoresistance is one of the worst threats of new and emerging infections and so is currently one of the main dangers to human health given that the loss of efficacy of many medicines due to greater resistance of bacteria and viruses threatens the medical advances made in the last few years and impedes the curing of many diseases. Simple pathologies such as throat and ear infections that have always been simple to treat could soon be immune to antibiotics, as has happened with malaria and tuberculosis in some countries.

The microbial resistance is a natural biological phenomenon but today it is aggravated by the frequent misuse of antimicrobial medicines and the social indifference to this fact; the responsibility lies in the hands of everyone; the people who in some cases self-medicate, and others who pressure health workers into prescribing antibiotics even though they are not necessary, and doctors who, in some cases prescribe them unnecessarily, and finally the pharmaceutical industry which promotes greater consumption.

this phenomenon is affecting the rich countries as much as the poor: in the former because of the abuse of medicines, and in the latter because of under use, that also favors the appearance of resistances.

In countries such as Estonia, Latvia and certain zones of Russia and China, over 10% of those infected with tuberculosis harbor spores resistant to the strongest medication. Also Thailand has completely lost the possibility of using three of the most common antimalarial drugs. If that were not bad enough, in a large part of Southeast Asia there is 98% resistance to penicillin.

It is considered that the resistance to the antimicrobials linked to the sale of antibiotics without a medical prescription and frequent self-medication; deficient practices of infection control in many hospitals, and the scarce vigilance of medicines to which resistance could be generated.

II.E ADAPTATION MEASURES

The health adaptation measures to climate change should be implemented according to the local, national and regional reality depending on degree of affect, the degree of development achieved, the diseases sensitive to climate change present in the zone and the existing economic and social possibilities.

Therefore we should:

- Enrich knowledge of the impact of climate change on human health and diseases sensitive to climate change.
- Carry out studies of cost efficiency, cost efficacy and cost benefit for each method of control of communicable diseases sensitive to climate change.

⁶² The virus was identified by the Disease Control Center in the United States

- Publish the epidemiological results of the different health projects depending on the different climatic settings proposed for each zone.
- Establish an epidemiological monitoring system that incorporates vectoral and climatic parameters at a global level.
- Motivate the different actors in the health sector at a national, departmental and particularly local level to incorporate the aspects of the impact of climate change on human health into their policies, strategies, operative plans and health activities.
- Strengthen the local, departmental national and regional health networks so that they are prepared to respond to the direct effects (droughts, floods, storms, etc.) and the indirect effects of climate change (increase in the demand for health services).
- Offer alternative mitigating measures for the levels of impact on health that incorporate biological, entomological, ecological, climatic aspects into the traditional measures being instigated up to now.

The recent advances in genetics suppose that they can be applied as adaptation measures in the not too distant future, for example the identification of chromosomes that give resistance to malaria (already present in some African populations) could be bound to the rest of the DNA of the population at risk, which would notably improve the survival rate of people with diseases transmitted by vectors, which in turn are favored by climate change.

Cloning could decrease the mortality rate of infectious diseases susceptible to climate change, such as malaria, by providing additional or easily replaceable globular packages to treat the complications brought about by malaria or other diseases.

The possibilities are endless and it cannot be denied that genetic engineering will facilitate better adaptation the effects of global climate change.

II.F VULNERABILITY AND ADAPTATION OF HUMAN HEALTH FACED WITH CLIMATE CHANGE IN BOLIVIA.

The vulnerability and adaptation of human health faced with climate change in Bolivia study carried out by the National Climate Change Program (NCCP) of the Vice Ministry of the Environment, Natural Resources and Forestry Development (VMENRFD) of the Ministry of Sustainable Development and Planning, studied two the current and projected vulnerability of two diseases with the impact of climate change and found the following results:

II.F.1 Malaria

Malaria is sensitive to variations and changes in the climate showing marked differences between the base line period and the current situation.

Currently the malaria produced by *Plasmodium falciparum* is biseasonal in two incremental periods (March-June, October-November) with periods of remission during the other months. However, cases are presenting over more months, which is important given the high death rate from malaria.

The number of cases produced by *Plasmodium vivax* rises between April and June peaking in May.

There has been a change in the behavior of the incidence (increase) that has been observed since March 1993 in cases produced by *P. falciparum* and since April 1994 in cases produced by *P. vivax*.

Climate change may favor an increase of 11.3% in the development of new cases of malaria produced by *Plasmodium vivax* and 43.6% in the cases produced by *Plasmodium falciparum*, with an average increase of 30% for both.

The presentation of malaria because of *P.falciparum*, according to projections for 2010, is intensifying and will vary its seasonal pattern, becoming triseasonal with a new peak in January, the continuation of the April-May peak and the transferal of the third October-November peak to August-September. This means that the disease will not only intensify but will also vary its seasonal pattern as a consequence of climate change.

The health risk is alarming for the two types of malaria (produced by *P.vivax* and *P.falciparum*) since their incidence would rise by 12 to 20% in the next few years. However, the future would be much worse in the case of malaria produced by *P.falciparum* that would mean an increase in the mortality rate of the population given the high lethality percentage of this type.

From an ecological point of view, hyper endemic areas of malaria correspond to eco-regions: tropical humid forest (municipalities of Pando), in the transition from subtropical wet forest found in the municipalities of Riberalta and Guayaramerin, and in the subtropical wet forest where there are many flooded savannas in the Itenez Province in the Department of the Beni.

The change from tropical wet forest and subtropical wet forest to expanses of tropical dry forest will provide adequate habitat for the malaria vectors to increase their geographic domain to areas outside their traditional areas where they were not present previously

The consequences will be: an increase in nesting, an increase in the number of insects favored by the changes, mainly due to an increase in humidity, the geographical and altitudinal extension of their habitat and finally a considerable increase in the cases of malaria due to the little immunity developed by the inhabitants of the newly affected regions.

II.F.2 Leishmaniasis

The study showed that the increase in the numbers of mosquitoes and the modifications in the eco-regions that would be caused by global warming would permit a clear definition in the seasonal behavior of leishmaniasis, with a tendency to increase the incidence in high-risk areas as a consequence of interannual and seasonal variations of the atmospheric processes.

The results show that Leishmaniasis is highly vulnerable to climate change, (the climate change can favor a rise of 34% in cases if the conditions are right) which would rise if there were increases in temperature, humidity, etc., in the months of July to September peaking in August according to the projections for 2010.

II.F.3 Adaptation Measures

The future predicted could be modified if adaptation measures are implemented: prevention, education, treatment of those infected, combating the vectors and an adequate management of the environmental measures.

II.G HEALTH STRUCTURES RELATED TO CLIMATE CHANGE

Thanks to the work of the NCCP, the health organizations such as the Ministry of Health and Social Security (particularly the Department of Epidemiology), some universities like the Universidad Mayor de San Andrés, CENETROP, the La Paz Departmental Health Service, the Medical Association and medical professionals in some public hospitals have received certain information on the topic, which is very new for the health community in Bolivia.

Nevertheless, there is no information system to climate change. The National Information Subsystem, now integrated into the network of the National Institute of Statistics, is the only system that provides health information, through an integrated network that covers local through to national levels. There remains much work to be done on the prevention of the negative consequences of climate change on human health.

III. INTERNATIONAL ORGANISATIONS, PROGRAMS AND SUMMITS

III. A INTERNATIONAL COOPERATION ORGANISMS

III.A.1 World Health Organization (WHO)

The health-disease relation has been linked to man and has accompanied him from the dawn of time. Even though medical-scientific research has been carried out since ancient times (always according to the possibilities of each age), there has been a lack of an international organization to promote and recommend different actions related to prevention and health promotion at an international level.

This proposal began with the First International Health Conference in Paris 1851, after cholera caused the death of thousands of people in Europe in 1830. The objective was to set up an International Health convention. The initial attempts failed but the work of the convention continued and finally was adopted in 1892 by various European countries.

However, as recently as 1945 the United Nations conference unanimously approved in San Francisco a proposal from Brazil and China to set up a new, autonomous world health organization. One year later the International Health Conference in New York approved the constitution of the WHO, and named an interim commission.

On the 7 April 1948 the WHO was set up with the signing of 26 of the 61 countries and that day was declared World Health Day. Currently there are 191 member countries that each count on different regional organisms and receive the collaboration of many governmental and non-governmental organizations.

The WHO is a double reference point, first, from the technical and scientific point of view, to highlight specific health doctrines such as infectious diseases, and secondly, a political reference point, to promote programs that promote healthy lifestyles, health for all, and prevention in the workplace and schools.

The pectoral aspect of the WHO was lost over time and it became an organization that is not only aimed at those responsible for health, but also works in social, economic, environmental and public administration aspects focusing on health not only from the biological point of view but also the holistic and intersectoral.

The primary health care strategy promoted by the WHO, has definitely revolutionized healthcare by improving health education, prevention, promotion, public access to health services and attention to damages.

The goal of the WHO, adopted in 1978 at the meeting at Alma Ata (Russia), was "health for all in 2000". It had to be revised since the time period was too short for some countries characterized by the elevated incidence and prevalence of diseases, mainly infectious and parasitic.

III.A.1.1 WHO achievements

In the last fifty years, life expectancy has increased by over 40%, going from 46 to 65 years in 1996. This is definitely the greatest achievement in terms of international public health in the last half century. However, this is not the only achievement given that the eradication of smallpox significantly reduced the number of deaths due to this disease.

As well as smallpox, the WHO assures that it is willing to “eradicate and eliminate another six diseases that cause public health problems before 2000: poliomyelitis, leprosy, neonatal tetanus, Chagas disease and iodine deficiency disorders”. However, at the end of 2000 these diseases are still a scourge in health terms in spite of important reductions.

In these 52 years the WHO has developed over 200 norms to support an international network of first-class scientists and laboratories. It has designed and promoted a large number of programs dedicated to the majority of diseases, as well as initiatives that report inequality, poverty, lack of political will to solve social and health problems, etc., as well as factors that directly affect the health of the population.

Their efforts were dedicated to all groups, but with children as the priority. Their efforts have been reduced as they now work with UNICEF in the field of infantile diseases. The vaccination campaigns against diphtheria, tetanus, whooping cough, measles, poliomyelitis and tuberculosis have given good results. Eight out of every ten children around the world are vaccinated each year against these diseases, which has meant a sharp drop in child mortality - 134 children per 1000 live births in 1970 to 80 in 1995.

The organization also promotes the prevention and treatment of serious infantile diseases such as pneumonia, diarrhea, measles, malaria and malnutrition, which are implicated in 70% of infantile deaths around the world. It is considered that better access to primary health care has contributed greatly to the achievement of these progresses.

III.A.1.2. Global Programs and Strategies

The WHO adopted an important strategy: Primary Health Care in 1978 at the meeting at Alma Ata (Russia) – and many of the most important achievements in the last few years should be attributed to this and the “Health for all in 2000”.

In spite of the important achievements produced in the field of health such as the increase in life expectancy, the control of infectious diseases with the consequent reduction in child mortality, mainly due to the advance in control of poliomyelitis, measles and diphtheria, the three evaluations of the WHO on the scope of the goal Health for all in 2000 indicated that great efforts were still needed to achieve this goal as large groups of the population lack access to services.

- Broadcast scientific and technical information through its program of health publications, its website and a network of academic libraries, archives and local libraries.
- Provide technical assistance in a variety of fields specialized in public health and organize preparations for emergency situations and the coordination of rescue operations in the case of disasters.
- Support the efforts to control malaria, Chagas disease, urban rabies, leprosy and other diseases that affect the people of the Americas.
- Collaborate with governments, other organisms and private groups to tackle the main nutrition problems, including protein-energy malnutrition, and is currently working to eliminate iodine and vitamin A deficiencies.
- The PAHO trains health workers at all levels through scholarships, courses and seminars and strengthens national training institutions.

III. A. 2. The Pan-American health Organization (PAHO)

The PAHO is an international public health organism that acts as a regional office of the Americas for the WHO. Its seat is in Washington DC and there are offices in 27 countries and 9 scientific centers throughout the Americas.

The basic mission is to technically cooperate with the member states and stimulate cooperation among them to ensure that the population of the Americas attains "Health for All".

The PAHO promotes the primary health care strategy as a way of extending health services to the community and increase the efficiency in the use of scarce resources. It directs its activities to the most vulnerable groups, children, workers, the poor, the elderly, refugees and displaced people.

III. A.2.1 PAHO achievements

All the health achievements in the Americas counted on the participation of the PAHO, and we should highlight some, such as the eradication of smallpox⁶¹, and the drop in episodes of acute diarrhea disease, as well as a significant reduction in mortality through infectious intestinal diseases and acute respiratory diseases.

The eradication of poliomyelitis indicated in 1985 was successful in 1994, when a prestigious international commission declared the Americas officially free from poliomyelitis.

It is promoting and almost achieving the goal of eliminating measles and neonatal tetanus in the region and is insisting on the introduction of vaccines such as Haemophilus influenza B to reduce meningitis and respiratory infections.

Almost all countries in the Region have laws and regulations for the prevention of diseases transmitted by blood transfusion and all blood is examined for syphilis and HIV, most have a system to monitor for hepatitis B.

III.A.2.2 Regional goals and strategies

PAHO has among its fundamental purposes the promotion and coordination of efforts of the countries in the Americas to prolong life, combat diseases and stimulate the physical and mental improvement of their populations.

Based on this and recognizing the differences in access to, coverage of and benefits of health of the Region's population, the countries have agreed to renew their commitment to achieve Health for All. Therefore PAHO's greatest efforts are directed towards this goal until reaching the maximum degree of physical, mental and social wellbeing for all the inhabitants, eliminating existing inequalities in health.

REGIONAL HEALTH GOALS FOR THE COMING YEARS

- Life expectancy at birth to increase by at least 2 years in countries that in 1998 had a life expectancy of less than 70 years;
- The child mortality rate will drop by 10 % and the perinatal mortality rate will drop by 20 %;
- Neonatal mortality will drop by 30%;
- Child mortality will drop by 40% and be less than 50 per 1,000 live births;
- Maternal mortality will drop by 25%, and at least 60% of women between the ages of 15 and 44 will have access to contraceptives;
- Less than 20% of children below the age of 5 will have growth retardation;
- Less than 10% of newborns will weigh under 2.5 kg.;
- Iodine deficiency diseases will be eliminated;
- Sub clinical hypovitamin A in children under the age of 5 will be less than 10% (prevalence);
- The prevalence of iron deficiency in women between the ages of 15 and 44 and pregnant women will drop by 30%;
- The elimination of poliovirus will be maintained
- Measles will be eliminated in the Region

- The incidence of neonatal tetanus will be less than 1 per 1,000 live births at a district level (municipal, cantonal, etc.)
- The prevalence of dental caries will be reduced by c50%
- The transmission of human rabies by dogs will be eliminated as well as the transmission of Chagas disease by *Triatoma infestans*
- Foot and mouth disease will be eliminated in all the countries of the Southern Cone.
- At least 80% of the population will have total adequate services for the disposal of waste water and elimination of fecal matter;
- At least 75% of the population will have access to potable water. All countries will have adopted policies to promote health for all and equitable access to high quality health services;
- All blood banks will have quality control standards;
- All countries will have policies to prevent the consumption of tobacco by children and adolescents;
- All countries will have a reliable health information system

Source: PAHO/WHO

The regional strategies designed by the PAHO for the region are broad and cover almost all diseases and other damages to health. In relation to climate change the PAHO is developing actions to control new, emerging and reemerging diseases and disasters.

III.B INTERNATIONAL ORGANISATIONS, PROGRAMS AND SUMMITS

One of the most current transcendent international trends is globalization. This phenomenon in the economic arena is aimed at the homogenization of the macro economy with a substantial improvement in the general economic indexes, although without a significant decrease in the inequalities existing in the distribution of employment and the access to goods and services.

Globalization is reflected in the strengthening of democracy, the generalization of the economic model (neoliberal), the formation of regional and sub regional blocks⁶², the revision of the role of the state and social participation.

In the economic arena, the tendency to the homogenization of the macro economy is clear, making way for an improvement in the general economic indexes, although there have been no successes in the social arena where there is still inequality in the distribution of and access to goods and services and the lack of employment generation.

This growth with unequal distribution and unsatisfied demands is provoking general unrest in forgotten segments of the population, which represents a latent threat to the prosperity that is hardly visible achieved over the last few years. This has led to efforts being oriented to the social sector by the national as well as the international finance institutions, which are participating more in the social sector.

Globalization is directly reflected in the commercial plan, where the role of health, from an environmental point of view, food security, the circulation of pharmaceutical products, and the production of the workers and the general population is clearly seen.

This is why the activities first designed in the commercial plan as the leaders in the process of regional and sub regional integration in the of the Americas Free Trade Association (ALCA), the North American Free Trade Treaty (TLC), the Mercado Común del Sur (MERCOSUR), the Sistema Andino de Integración; the Central American Integration System (SICA) and the Caribbean Community (CARICOM), have had to include the topic of health as an important factor in negotiations.

- The Americas Summit in Miami in 1994 also included the topic of health and applies the Health Action Plan, which highlights the collaboration of different Inter American organisms such as the PAHO, the Organization of the American States (OEA) and the Inter American Development Bank (IDB).
- Following the last meeting, the Summit on “Health Technology uniting the Americas” was held in Santiago, Chile that includes vaccinations, essential medicines, health information technologies, health monitoring systems and technology appropriate for basic health. This initiative headed by the PAHO seeks better technology transferal, greater solidarity and cooperation among the countries of the Region.
- This phenomenon of continental interrelation policy passes regional borders, such as in the case of the Iberoamericana summits of presidents and heads of state, during which, on two occasions, the health topic was covered, proposals elaborated and regional initiatives adopted.
- Also regionally, the conferences of the first wives of the Americas supported a series of health initiatives.

The importance of the environment (contamination, climate change, UV radiation, deforestation, etc.) and its impact on human health is making the international community begin a series of national and international movements with the aim of decreasing environmental damage, and begin mitigation measures.

III.B.1 United Nations Framework Strategy on Climate Change

The United Nations Framework Strategy on Climate Change considers human health in inciso (f) of Article 4 or the COMPROMISOS signals: “ take into account, as far as possible, the considerations relative to climate change in the pertinent social, economic and environmental policies and employ appropriate measures for example, formulated and determined impact evaluations at a national level, with goals to reduce to a minimum the adverse affects on the economy, public health and the quality of the environment of the projects or measures undertaken to mitigate the climate change or adapt to it”

III.B.1 Sustainable development and environment summits

The last summit in the city of Santa Cruz in 1997 approved 6 initiatives for action in health and recognized that the main challenges to achieve sustainable development in the field of health include:

- The development of social awareness of economic, social and environmental concerns to open ways for the transition of our societies to sustainable development
- Equal access to the health services as well as improving their quality according to the principles and priorities established in the Pan-American letter on Health and Environment in Sustainable Human Development, taking into account the diseases related to the environmental deterioration.
- The decrease in negative environmental effects on health, particularly those related to the mortality and morbidity of the most vulnerable groups, such as women and children
- The establishment and/or strengthening of the capacity to react to outbreaks of diseases in cases of disaster, as well as the institutions in charge of the policies and their capacity to respond.

From the above, it can be concluded that the health sector will have to adjust itself to this new global, regional and national reality and, at least, the strategic and programmatic orientations of the organizations will have to be adapted to the environmental conditions with climate change among them to be able to contribute to the successful result of the search for health for all in the 21st century.

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ANNEX No 3

EDUCATION AND COMMUNICATION

Analysis of National and International Context for Climate Change Education and Communication

Dr. Marilyn Aparicio Effen

ANALYSIS OF NATIONAL AND INTERNATIONAL CONTEXT FOR EDUCATION AND COMMUNICATION FOR CLIMATE CHANGE

GENERAL GUIDELINES FOR NATIONAL EDUCATION AND COMMUNICATION PLANS FOR CLIMATE CHANGE

PURPOSE

The document **GENERAL GUIDELINES FOR NATIONAL EDUCATION AND COMMUNICATION PLANS FOR CLIMATE CHANGE (GGNECPCC)** is the starting point for application of education line of the National Implementation Strategy (NIS) of the United Nations Framework Convention on Climate Change (UNFCCC).

OBJECTIVES

- To establish general lines for next development of education and communication plans in different national sectors (education, health, food security, agriculture, industry, cattle farming, energy, etc.)
- To incorporate themes related to climate change within formal and non formal education systems.
- To initiate, national awareness raising of human responsibility for climate change.
- Motivate sectoral authorities to include the topic of climate change in national policies and strategies.
- To promote development of education and communication plans that decrease the human vulnerability to the impacts of climate change in Bolivia.
- To respond to strategic lines for Bolivia's adaptation to climate change defined by the NIS.
- To incorporate factors related to climate change (mitigation, adaptation and vulnerability reduction) into national, departmental and local development.
- To serve as a basis for incorporation of subject climate change within the curriculum and the education activities carried out by different educational bodies in each sector.
- To promote the implementation of a new development model (sustainable, non-contaminating and economically productive)
- To establish the bases for development of education and communication plans for mitigation of emissions leading to climate change⁶³.

⁶³ In those sectors still undeveloped

TARGET GROUPS

The groups that are targeted by the GGNECPCC are made up of the national, departmental and local authorities, functionaries and staff in the different national sectors (public or private), civil society institutions, NGOs, civil defense organizations and the general population.

Therefore, it is aimed at all levels of Bolivian society who will be affected, or whose activities will be affected by the impacts of climate change.

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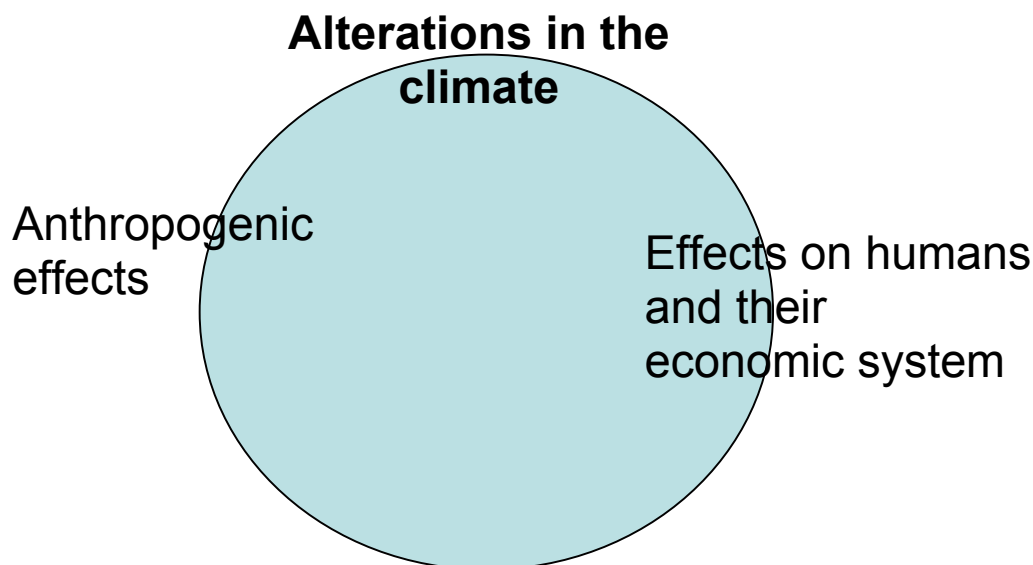
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GENERAL GUIDELINES FOR THE EDUCATION AND COMMUNICATION PLANS FOR CLIMATE CHANGE (GGNECPCC)

I. INTRODUCTION

The continual population growth and the development model implemented by the more developed nations and partially implemented in the developing countries are constantly putting pressure on the natural resources and land eco-systems. The production-consumption model adopted in the last few decades is particularly damaging to the components of the climatic system and the atmosphere⁶⁴, thereby creating serious impact on the environment in general and the socio-economic systems.



The climate is a product of the balance produced by the exchange of energy, mass and kinetic energy among the different components: the atmosphere, the hydrosphere⁶⁵, the cryosphere⁶⁶, the lithosphere⁶⁷ and the biosphere⁶⁸. The climatic conditions of any given place and time of the year will be subject to the distribution of the components mentioned before and will be specific to a group of variables (temperature, precipitation, wind, humidity, etc.) and the probability that they will have different values.

The atmosphere is the layer of gases that surrounds the planet. It represents one of the most important components of the terrestrial climate because its energy budget determines the state of

⁶⁴Currently the self-regulating capacities of the atmosphere are being stretched to their limits and, according to many are exceeded.

⁶⁵ Fresh and salt water in liquid form

⁶⁶ Water in solid form

⁶⁷ The earth

⁶⁸ the different life forms on earth

the global climate and maintains the conditions necessary for life. It is a mixture of various gases and aerosols (solid and liquid particles in suspension) that form an integrated environmental system although it is not physically uniform due to there being significant variations in temperature and pressure generally depending on the height above sea level (GCCIP, 1997).

The gases mainly associated with greenhouse gases are N₂ and O₂, (CO₂, methane, nitrous oxides, ozone, halocarbons, aerosols, among others) that at their normal levels fulfill a crucial role in the atmospheric dynamics.

The greenhouse effect

The energy received from the sun should be balanced by the radiation emitted from the earth's surface. In the absence of any atmosphere, the surface temperature would be approximately -18 °C. This is known as the *effective terrestrial radiation temperature*. In fact the surface temperature is approximately 15°C.

The reason for this discrepancy is that the atmosphere is almost transparent to short-wave radiation, but it absorbs most of the long-wave radiation emitted by the earth's surface. The long-wave radiation is absorbed by certain atmospheric gases in its lower levels making the atmosphere warmer there and making life on earth possible. This is known as the natural greenhouse effect.

Various atmospheric components, such as water vapor and carbon dioxide⁶⁹, have molecular vibratory frequencies in the spectral range of earth's radiation belts. However, the greenhouse gases at current levels absorb and reemit long-wave radiation, returning it to the earth's surface, causing an increase in temperature, "*The Greenhouse Effect*" (GCCIP, 1997).

"We conclude that there has been a discernible human influence on climate as detected among the many natural climate variables" IPCC

Climate change

The greenhouse effect is generating global climate change, which is attributed directly or indirectly to human activities that alter the composition of the global atmosphere, and which is in addition to natural climate variability observed over comparable time periods (EEI, 1997).

To identify the root of the problem, we would have to look at almost any aspect of the productive and social model adopted since the 17th century, based on the growing use of fossil fuels: coal, petroleum, and natural gas. Industry, the transport of people and goods, the generation of electricity, heating, certain agricultural practices, industrial and domestic refrigeration and climatization practices are all examples of daily activities that contribute to the problem by emitting greenhouse gases.

- Evidence of climate change:

⁶⁹ During the last two centuries, human activity has given rise to an enormous increase of greenhouse gases, especially carbon dioxide, being incorporated into the atmosphere altering its composition and provoking the greenhouse effect.

Since 1900, the earth's average surface temperature has risen between 0.3 and 0.6 degrees C. for 2100 an increase of 3.5 degrees C is expected. This will be a change in temperature comparable to that produced between the last glacier-age and today.

The melting of the polar caps and the glaciers could cause a rise in sea level of up to one meter per year by the year 2100. If this is the case then whole countries will be submerged and the world map will be radically changed.

The hottest ten years on record have been since 1980. 1996 was the hottest five years since registers began in 1866.

In the last century the level of CO₂ in the atmosphere rose by 25%; the level of nitrous oxide rose by 19% and the level of methane by 100%.

The emissions of carbon dioxide due to the burning of fuels have increased by 6.25 billion tons in 1996, a new record⁷⁰.

It is also estimated that damages related to climate disasters reached 60 billion dollars in 1996, another new record (GCCIP).

The most greenhouse gas effect emissions are mainly centered in the developed countries. However, it is likely that the developing countries will increase their emissions as they increase their economic activity by following the same development model.

The countries whose economies are dependent on the production, use and export of fossil fuels have specific difficulties and so the response to their problems should be coordinated and integrated with their socio-economic development without forgetting their needs, achievements and goals for growth, among these being poverty reduction.

The atmosphere and the processes that maintain its characteristics do not have rapid reaction times compared to human time spans, therefore the solutions to the thinning of the ozone layer, global warming, devastating alterations in the climate cannot come in a matter of years, or even decades. This is why immediate action should be taken as even if we wait for the effects to become obvious, it will be too late to look for solutions.

The global climate change has made environmental problems all too clear and so it is impossible and futile to act alone. There needs to be a global company involving all countries in the handling of actions that lead to the reduction of vulnerability, adaptation, mitigation of greenhouse gases and scientific research.

I. A VULNERABILITY AND ADAPTATION

Vulnerability

The concepts of vulnerability and adaptation are far from being simple. They are multi-dimensional and are markedly different from each other. According to the UNDP and the GEF⁷¹ we can see that vulnerability (V) to the climate and climate change is a function of the impacts (I) less adaptation

⁷⁰ IPCC

(A) therefore:

$$V = I - A$$

The impacts are a function of the climatic system and the exposure to the environmental and socio-economic systems, which can rise due to intensification in the frequency of the climatic events or an increase in their exposure. As a result of the population growth and economic development, there is a larger number of people and property exposed to the adverse effects of climate change that are then more susceptible to large losses.

The degree of exposure is the result of historical processes that increase exposure and vulnerability including:

- Growth in human settlements in flood planes or unstable slopes
- Expansion of agriculture within areas of instable rain precipitation
- Occupation and use of low-lying coastal areas
- Movement of small agriculture from mosquito-free zones to mosquito-infested zones

Vulnerability comprises of all the factors generated by climate change that can damage or destroy a system which does not only depend on the sensitivity of the system, but also on its ability to adapt to new climatic conditions⁷².

Adaptation

The capacity of the human systems to anticipate the impacts and their variability to climate change makes them different from natural systems⁷³, due to the fact that their reactions can be forward planned and potentially reduce the vulnerability and the costs associated with climate change, despite what happens with the autonomous adaptation of ecosystems. However, it will be affected by the levels of socio-economic development and the framework of policies and strategies in a certain region of country.

Therefore we consider adaptation as a spontaneous or planned adjustment in response too anticipating the conditions of climate change: Adjustments that can be made in practices, processes and structures⁷⁴.

Adaptation is an active process that can be carried out with or without political intervention. The understanding of these processes requires the analysis of set seasonal patterns, and the adaptation base lines need to take into account the past seasonal patterns of climatic variability and adaptation to them. The extension of the patterns will depend on the availability of data and information, also considering that the selection of adaptation measures is economic by nature and depend on the level of income and availability of technology. The patterns will not be useful if they extend back far into the past so one or two decades will be sufficient.

There level of development on a global scale has accelerated and grown significantly in the last few decades, as the annual income per capita demonstrates by having risen from 0.6% in the 19th century (industrial expansion) to over 2% per year in the period following the Second World War (Cooper 2000) characterized by high technology innovation and global economic cooperation.

Some analysts attribute this improvement to the combination of stability of the national economies due to governmental management and free trade. However, this level of development continues to

⁷¹ An Adaptation Policy Framework , UNDP – GEF Project May 2001 Canada

⁷² Climate Change Second Assesment IPCC 1995

⁷³ IPCC Working Group II 2001

⁷⁴ Climate Change Second Assesment IPCC 1995

be a fantasy for a large part of the world's population as there is a great disparity between the levels of development among different countries and even regions of the same country⁷⁵.

The gaps between rich and poor, among developed and developing countries and Latin American, Tropical Africa and Asian countries are wide (UNDP 1999). Although there has been a notable advance, many countries in these regions have experienced increases in economic instability, social insecurity, environmental degradation and endemic poverty. In spite of the spectacular gains in terms of international development, such as in science, technology and medicine in the last century, development planning at a national and global level has never alleviated poverty, inequity and hunger⁷⁶.

Given this panorama, the capacity to adapt varies considerably among countries, regions and socio-economic groups, where the poorest countries and communities are the most vulnerable and exposed to the effects of climate change by their having a limited capacity to adapt.

At a national or local level, the implications of climate change should be placed in the center of the socio-economic context, which is critical to evaluating the vulnerability of the sectors or regions to the impacts, and with the aim of the national or local authorities considering this topic within a wide range of implications of technological and organizational choices of adaptation of the natural and social systems to climate change.

As an important part of the social response to climate change, countries should implement policies, programs and adaptation measures and reduction of emissions to decrease vulnerability and obtain immediate and future benefits from the mitigation of emissions.

Therefore the governments have begun a range of responses found within the international evaluations of climate science, impacts and strategies of reduction (e.g. the USA), the implementation of legal policies for obligatory mitigation (Sweden), the use of efficient energy, public transport, renewable energy and fuel conversion (gasoline to gas), the elaboration of national studies and communications, the use of political social instruments as awareness raisers, social information and technical assistance, as well as creating opportunities for research and forums to exchange ideas.

At local levels, many cities, mainly in developed countries, have adopted goals for the reduction of emissions and have taken measures to implement them (mostly in the energy and transport sector). In many cases these policies have been defined to combine climate protection objectives with more local objectives (so-called joint benefits) such as the reduction of air pollution, traffic congestion, or the production of waste. Private organizations have developed plans to commercialize carbon emissions; the NGOs have started campaigns to raise the awareness of the population.

In general, most of the social and economic sectors, including agricultural, forestry, settlements, industrial, transport, human health and the management of hydric resources should gradually change to adapt⁷⁷ to the effects of global climate change.

- Vulnerability and Adaptation of the soil and water eco-systems

The geographic composition and distribution of most of the ecosystems would be displaced as the different species react to the climate changes, so reductions in biological diversity and the goods and services provided by the ecosystems to society would be expected. Some ecological systems perhaps would not reach a new balance for many centuries after the effects of climate change⁷⁸

⁷⁵ These differences are coloured by the average global income growth as reported by Cooper

⁷⁶ Global food security has clearly improved in recent years, but the number of people at risk of being hungry remains high

⁷⁷ Considering adaptation as an active and dynamic process

⁷⁸ Climate Change Second Assessment IPCC 1995

- Vulnerability and Adaptation of Water and hydric resources

Climate change supposes an intensification of the global hydric cycle and could notably affect the regional hydric resources. The modifications in the volume and distribution of the waters could affect the supply of subterranean and surface waters for domestic and industrial use, agriculture, the generation of hydroelectric energy, navigation, etc.

- Vulnerability and Adaptation of foods and wood

In the agricultural sector, the crop yields and the changes in productivity due to climate change will differ enormously among regions and zones, modifying its production patterns to increase in some zones and decrease in others.

It is expected that there will be a decrease in wood in the next century due to climatic and non-climatic factors.

- Vulnerability and Adaptation of the human infrastructure

Climate change and its modifications, such as the rise in sea level, will have various negative effects on energy, industry, infrastructure, transport, human settlements, insurance, travel and tourism, cultural systems and values.

- Vulnerability and Adaptation of human Health

The impact of climate change on human health encompass a large variety of effects particularly adverse for human life with numerous losses due to the direct causes of climate change and particularly to the indirect causes, which tend to perpetuate themselves.

Direct causes affect human health directly and immediately. For example, heat waves, landslides, floods that can injure or kill. The indirect effects are those that will be seen immediately and through intermediaries such as vector transmitted diseases as a result of the wider geographical and seasonal spread of the transmitters.

I. B MITIGATION

Scientists acknowledge that the world should decrease its emissions of greenhouse gases between 50 and 70% to stabilize the current level of gases in the atmosphere⁷⁹.

To be able to reduce the greenhouse gases that are freed during the fabrication or industrialization processes, modifications are being made to the processes of production, the suppression of solvents, the use of alternative raw materials, the substitution of materials, the capture of methane in spillways, the installation of sewage treatment plants, the reduction of halocarbon leaks in mobile and fixed sources, etc. (each one of the measures and many others will depend on the commitment of the sector involved).

⁷⁹ However, the projections indicate that the emissions of these gases will continue to rise in the next decades

Main Options for Mitigation

- Construction sector

Since 1971 the CO₂ emissions have had an annual growth rate of 1.8%, so the sector has contributed 31% of the global emissions of energy related to the CO₂ emission in 1995. However, technology is providing hundreds of measures to improve energy efficiency in the applications and equipment as well as the constructions around the world. It is now estimated that this will cause a drop in emissions to 325m³⁸⁰ for the year 2010 in developed countries and 125m³ in developing countries. In the developing countries, the market structure is not apt for an increase in efficiency as there is a lack of initiative, information and economic resources, which are all recognized as obstacles to emission reduction.

- Transport sector

The transport sector has advanced rapidly and the automobile industry will put non-contaminating vehicles on the roads in 2003. The effects on the mitigation of GHG will depend on the cost of the fuel in countries where it is high. E.g. In Europe the impact will be 40% whereas in the USA where the price of fuel is low, the drop will only be 20%. The effects of GHG reduction including the rebound effect could reduce the emissions for 2010 between 5 and 15% and between 15 and 35% by 2020 compared with the baseline of continual growth.

- Industrial Sector

The efficient use of energy is the main option to reduce industrial emissions so the decrease would be 300 to 500MT³ for 2010, and between 700 to 1100 MT³⁸¹ for 2020. According to the IPCC⁸² these sectoral options would have a low cost and would be negative due to the fact that the emissions of gases other than CO₂ are generally small and could be reduced by over 85%.

- Change in the use of land and forests

This sector has three main ways of mitigating the increase in CO₂ in the atmosphere: protection, sequestration and substitution. These options have different seasonal patterns and so the choice and the potential efficacy depend on the time, such as the productivity and the particulars of the damages. The estimates of the benefits of the implementation of these measures put the reduction of atmospheric carbon at between 83 and 131 Gt³ for 2050 (60 to 87 Gt³ in the forests and 23 to 44 Gt³ in cultivated lands).

- Agriculture and waste management

Energy requirements are rising at around the rate of 1% per year around the world, with an elevated increase in the countries that do not belong to the European Union. Because of this various options have been put forward to decrease the GHG emissions⁸³, to invest US\$50 per 150/t³, which would include increasing the deposit of carbon for the management of crops, reduce the methane emissions to improve cattle and rice production.

Likewise the sequestration of carbon from the ground, the reduction of nitrous oxide from animal waste and the application of nitrogen measures is possible in most regions through technology transferal and incentives for farmers to change their traditional methods. Waste management would

⁸⁰ Megatons of carbon

⁸¹ Megatons of carbon

⁸² Climate Change 2001 Contribution of Working Group III to the Third Assessment Report Of IPCC

⁸³ Greenhouse gases

decrease the GHG emissions by MT³ for 2010 and by 320 MT³ for 2020 compared to 240 MT³ in 1990.

- Garbage Management

In various industrialized countries and especially in Europe and Japan, the facilities to generate energy from waste is proving to be more efficient and have a lower level of pollutant emissions. The recycling of paper and fiber and the use of waste paper as a fuel also have their advantages.

- Energy sector

There are two options available to the energy sector: increase transformation efficiency and increase the primary use of energy with fewer GHG emissions per unit of energy produced by carbon sequestration and reduction of GHG escapes.

The options to reduce the emissions per unit of energy produced include new renewable energy forms that, despite their strong growth, only provide less than 1% of the energy produced around the world. New projects to capture CO₂ and the possibility of achieving “clean fossil fuel” have arisen, which could compete with costs.

II CLIMATE CHANGE IN BOLIVIA

The predictions of the effects of climate change, particularly of the distribution, time-frames, magnitude and regional characteristics, have wide levels of variation and uncertainty.

The country is characterized by vast tropical areas, mountain ecosystems, arid areas susceptible to flooding, areas that are forested and subject to environmental degradation. The IPCC signals that *“ the small island countries, those countries with low-lying coastal areas or arid or semi-arid zones, or liable to flooding, droughts and desertification, as well as developing countries with fragile mountain ecosystems are the most vulnerable to the adverse effects of climate change “*.

And so Bolivia is a country particularly vulnerable to the adverse effects of climate change and is obliged to place special emphasis on increasing its capacity to adapt to and actively and responsibly contribute to the reduction of GHG at a national and international level to stabilize the world climate system.

II.A VULNERABILITY and ADAPTATION

The Bolivian population is increasing at over 2% to 2005⁸⁴, and is being presented with new economic possibilities through the discovery of gas reserves and the potential foreign markets for this fuel. However, the current economic crisis and the growing levels of inequity among the different regions of the country are promoting the intensive use of the natural resources.

- *Vulnerability and Adaptation of human Health*

The evaluation of the vulnerability of human health has shown the high susceptibility of the Bolivian population to the increase of contagious diseases, mainly those transmitted by vectors⁸⁵. This makes it necessary to reconsider the role of the environment within the National Health Programs,

⁸⁴ The 2001 census will provide more data

⁸⁵ NCCP, VMARNDF, MDSP, PAHO/WHO GEF/UNDP , “Vulnerabilidad y Adaptación de la Salud Humana Ante los Efectos del Cambio Climático en Bolivia”, 2000 La Paz – Bolivia

including the topic of climate change in the epidemiologic evaluation and the need to strengthen education in environmental health, highlighting the health impacts of climate change.

- *Vulnerability and Adaptation of the Agriculture sector*

An increase in cultivated areas is expected where the evaluation of vulnerability indicates that the rise in temperature of up to 2°C would not seriously damage the ecosystem if it were accompanied by an increase in rains. In the Highlands it would actually increase the production of crops.

However, were the rains to decrease then the negative effects would be strong even if there were no increase in temperature. This would be directly and immediately felt in production and also in the ecosystem with desertification, salinization, destruction of the vegetation, deforestation, etc. Among the adaptation measures proposed⁸⁶ are the management of waters and soils, biodiversity, education, research and technology transferal.

- *Vulnerability and Adaptation of the forestry sector.*

In the forestry sector, the annual rate of deforestation is 168.012 hectares per year⁸⁷. One recently published study carried out for Santa Cruz⁸⁸ signaled an annual average deforestation of 203.433 hectares in this department alone, which exceeds the figure calculated for all Bolivia.

The elevated rates of deforestation associated with the effects of climate change on the forests would produce a strong impact, so there should be a series of options such as sustainable management (that is being done in some zones) that guarantees conservation maintaining the productivity of the forest, biological diversity and ecological processes.

The growth of the industrialization processes should maintain the maximum use of wood and its waste in such a way as to elaborate products with greater aggregate value.

- *Vulnerability and Adaptation of the hydric resources*

With reference to hydric resources, a general drop in the volume despite some seasonal rises has been forecast. Therefore within the adaptation measures proposed there is the coordinated planning of the use of the water in a certain watershed, regulation, irrigation and storage building, the adoption of conservation policies, quality control of the bodies of water, controlled and paid-for distribution systems, the adoption of contingency plans, the transferal of water between watersheds, an improvement in the systems to predict floods and droughts, training and education in the management and consumption of water.

- *Vulnerability and Adaptation of the livestock and pastoral sector*

In the cattle farming and pastoral sector the evaluation showed the sensitivity of cattle to climate change reflected in weight gain that would be favorable to its commercialization. However, the green biomass would decrease so the production of plants would depend on the length of the seasons and their variations. Among the measures set forth is the introduction of other types of cattle that are more resistant to the effects of climate change, migration, modifications of the pasture seasons and supplementary diet, and to identify resistant types of pastures and introduce native pastures.

⁸⁶Vulnerabilidad y Adaptación de los Ecosistemas al Posible Cambio Climático y Análisis de Mitigación de Gases de Efecto Invernadero, La Paz 1995 MDSMA, NCCP, EPA,USCP 1997

⁸⁷ Forestry map, Explanatory Reports, La Paz 1995

⁸⁸ Camacho O, Cordero W, Martínez I, Rojas D. "Tasa de Deforestación del Departamento de Santa Cruz, Bolivia 1993 – 2000", Forestry Regulatory Body, BOLFOS Santa Cruz 2001

The sectors most responsible for the highest emissions of GHG and also the most vulnerable to climate change are: farming, changes in land use, forestry and the energy sector and so there needs to be more mitigation measures, reduction of vulnerability, and adaptation.

Mitigation options in the Agriculture, livestock and Forestry sectors

- The mitigation measures to reduce the GHG emissions for the forestry sector are aimed at promoting and continuing the sustainable use of renewable resources through the utilization of lands according to their capacity for use, employing a system of adequate management. This refers to the formation of forest masses through reforestation and forestation, the natural regeneration of forests (alternatives to slash and burn agriculture) as forest carbon sinks, and support the implementation of the new Forestry Law.
- To promote the conservation of carbon in the forest biomass along with the sustainable use of the biodiversity resources, the following mitigation measure is proposed: the strengthening of the capacity to plan, protect and monitor protected areas.
- On the other hand, the mitigation measures aimed at the agriculture and cattle farming sectors are directed at improving crop yield and animal production but mainly at reducing the CO₂ and methane emissions. These refer to the prevention and control of land degradation through the implementation of agro forestry systems, the natural regeneration of pasturelands and the improvement of animal production techniques.

All the measures mentioned above were discussed and agreed upon based on technical analysis discussion groups. As a result of these interinstitutional meetings the following were excluded: the improvement of rice cultivation techniques in rain-fed areas and the gradual replacement of the use of chemical fertilizers as this could somehow affect the food security of the Bolivian population⁸⁹.

Mitigation options in the Energy sector

The following options for mitigation in the country have been put forth:

- To achieve efficiency in illumination through the introduction of compact fluorescent lamps when replacing incandescent filament lamps in all sub sectors
- Increase the efficiency in the residential (urban and rural), commercial and industrial sectors
- Seek efficiency in refrigeration in the residential sector (new models)
- Increase the residential use of natural gas through mass consumption for cooking and water heating
- Increase the use of natural gas in the transport sector and accelerate the rhythm of conversion of vehicles (diesel and gasoline) to natural gas
- Reduce the burning of natural gas in production fields through recovery and processing means, and the reinjection and recycling of natural gas.

⁸⁹ NCCP Nacional Climate Change Plan of Action for the Agriculture, Cattle Farming and Forestry Sectors, 2001

Taking into consideration the poverty in the country, and the opportunity presented to the local governments of having additional resources from the HIPC, works aimed at reducing the vulnerability, mitigating the emission of gases and developing adaptation measures in all sectors such as: guaranteeing water for human consumption, irrigation, and to promote the use of alternative energies, etc. should be promoted.

III. CLIMATE REFERENCE FRAMEWORK FOR EDUCATION

Global climate change is a fact. Even though there are some skeptics who do not represent the majority. This is why the world's governments have reacted to this ever-growing threat with a series of agreements that are international and to be applied nationally and regionally.

The most important international agreements consider education and communication as a fundamental strategy to achieve the goals and objectives of each one. These are detailed below.

III.A United Nations Framework Convention on Climate Change

The United Nations Framework Convention on Climate Change (UNFCCC) was signed in June 1992 at the Earth Summit in Río de Janeiro by heads of state and other country representatives of 154 nations and the European Community as a result of the scientific evidence that linked the emission of greenhouse gases from human activities and the risk of global climate change.

The UNFCCC came into force on 21 March 1994 and at the beginning of 1999, 175 states had ratified or complied with the terms of the convention. In 1997 the Conference of the Parties (COP) adopted the Kyoto Protocol, which obliges countries to collectively reduce greenhouse gas emissions by at least 5% for the period 2008 - 2012.

"Just over 50 years ago, Kyoto was spared from the destruction of the atomic bomb during the Second World War -because of its cultural significance as the ancient home of the Japanese empire. In today's warming world, as former empires come to terms with perhaps the most serious consequence of their industrial revolutions, Kyoto must now attain another, more peaceful, place in history as the site where humanity spared itself from disastrous levels of climate change. The IPCC that warns us also provides hope, pointing out that significant reductions in emissions are both technically and economically possible."

Seth Dunn. Earth Times

In November the COP 4 agreed on the Plan of Action in Buenos Aires. In 2001 the political agreements for the ratification of the Kyoto Protocol were approved but the goals for the fulfillment of the agreements were postponed for October 2001 in Morocco.

All the international and national efforts aimed at the decreasing of greenhouse gas emissions must necessarily pass through "education", which is one of the fundamental aspects for the carrying out of activities in any sector of human work. This is why article 4(i) of the Convention signals:

"Cooperate in and promote the education, training and public awareness of climate change and strengthen wider participation in the process including NGOs"

Article 6 refers to Education, Training and Public Awareness where it signals that in agreement with the agreement in article 4 paragraph (i) the parties agree to:

(a) Promote at national, sub regional and regional levels:

(i) the development and implementation of educational and public awareness programs on climate change and its effects

(ii) public access to information on climate change and its effects

(iii) public participation in addressing climate change and its effects and developing adequate responses

(iv) training of scientific, technical and managerial personnel

Article 6: Education, Training and Public Awareness

(b) Cooperate in and promote, at the international level, and, where appropriate, using existing bodies:

(i) the development and exchange of educational and public awareness material on climate change and its effects; and

(ii) the development and implementation of **education** and training programs, including strengthening national institutions and the exchange and secondment of personnel to train experts in the field, in particular for developing countries

Responsibilities of Bolivia within the UNFCCC

We should first consider some background that will enable us to better understand the national responsibilities within the UNFCCC.

- The Annex I countries of the UNFCCC will be able to relieve support from the parties that are not-Annex I in shared-risk countries for the reduction of emissions, ensuring that this reduction in emissions helps the sustainable development of the Parties involved and at a global level (Art. 6 KP).
- The Convention defines as a principle “in relation” to the vulnerability of the Parties facing global warming taking fully into account the specific needs and special circumstances of the Parties that are developing countries, especially those that are particularly vulnerable to the adverse effects of climate change (Art. 3.2 UNFCCC)

In UNFCCC terms, Bolivia as a non-Annex I country should frame its actions within the principle of “different responsibilities, shared concerns”, to find new levels of reciprocity, equity and compromise.

Bolivia should implement the UNFCCC by including in its national plans and programs mitigation and adaptation measures to climate change, within the framework of sustainable development adopted by the country⁹⁰. Also, the important conservation of forests as carbon sinks and the

⁹⁰ Developing countries such as Bolivia will have to define their priorities in the framework of the central objective of the Convention according to the national social and economic development policies and maintain their right of national sovereignty as well as the right to vote and voice in the working framework of the UNFCCC

diffusion of technologies, practices and processes that control, reduce or prevent the anthropogenic emissions of GHG.

The Bolivian projects to reduce energetic and non-energetic emissions will have to place special emphasis on the caring of natural resources and the generation of development opportunities for all the population, favoring those areas where the poverty levels are extreme.

- **National Climate Change Program**

Within the focus of Sustainable Development, and as one of the actions taken by Bolivia to respond to the United Nations Framework Convention on Climate Change, the **National Climate Change Program (NCCP)** was set up in 1995. It currently depends on the Vice Ministry of the Environment, Natural Resources and Forestry Development (VMENRFD) under the Ministry of Sustainable Development and Planning (MSDP).

The NCCP spearheads the formation of the Interinstitutional Climate Change Council (ICCC) and carries out various national studies such as Greenhouse Gas Emissions Inventories, Mitigation Options and the Evaluation of the Vulnerability and Adaptability of the Ecosystems to Climate Change among others.

- UNFCCC National Implementation Strategy (NIS)

Within the framework mentioned, Bolivia has elaborated the NIS, whose basic purpose is to define the strategic lines to integrate adaptation measures for climate change into the planning of the national development as implementation of the obligations of the country to the UNFCCC and the Kyoto Protocol, at the same time as generating a consensus on the national answers to climate change

The NIS outlines the institutional framework and functions for the implementation of the UNFCCC, the strategic lines for the implementation of the UNFCCC in Bolivia

The NIS, while being considered a planning tool, should be complemented by plans of action for each of its strategic lines and with levels of sectoral consensus necessary to make its implementation effective.

Therefore, the NIS will be considered the main rector of the General Guidelines for the National Action Plan for Education in Climate Change.

III.B AGENDA XXI

Agenda XXI considers education “**a way of awareness raising**” to modify attitudes, ethical values and technical knowledge of the people.

This is why the education processes, training and the need for people to become aware of the environmental problems and development appear throughout all the areas of Program XXI

The Program signals that the interests of the children⁹¹ should be taken into special consideration so emphasis is placed on children participating in the environmental education programs carried out

⁹¹ Everyone knows that the children inherit the responsibility for the Earth; however, their protection is not enough as they are the most vulnerable to the effects of environmental degradation

in schools or communities and in the policies and strategies related to the environment and the development in the local, regional and world plan.

On the other hand education should also stimulate the participation of local populations, including women, young people, children and indigenous people to achieve an integrated management of the resources at a community level.

The program instructs for the area of education:

- Prepare strategies aimed at the integration of the environment and development
- Create social awareness of the topic, integrating ecological and development concepts.
- Promote non-academic learning activities at the local, regional and national levels through the cooperation and support of the efforts of non-academic instructors and other community organizations.
- Promote programs about the environment and development for adults, women and indigenous peoples, basing them on local problems.
- Increase public awareness. The sensitization of the public of environmental and developmental problems and their participation in solving them are essential.
- Promote training. It should aim to share knowledge that help employment opportunities, and participate in activities related to the environment and development. It should also call upon all the industrial, university, government NGO and community sectors to include environmental components in all training activities.

III.C NATIONAL REGULATORY FRAMEWORK

The Ministry of Sustainable Development and the Environment was set up in 1993 with the mandate to achieve sustainable development and direct the organization of the national planning system. This is why its name was later changed to the Ministry of Sustainable development and Planning (MSDP).

Sustainable Development implies cultural changes in the pattern of development and consumption, which require great changes to the system of values, attitudes and social behavior, so the MSDP and its dependencies should help to generate strategies for the coordination and construction of consensus that facilitate these changes.

It should generate development initiatives in the local ambit, direct the selection processes and provide a response to these initiatives at the same time as generating opportunities for effective, constitutionally recognized participation of the decision makers and civil society in processes related sustainable development.

The environmental and development concerns of civil society were expressed in the Environment Law 1333⁹², identifying an urgent need to direct the country towards sustainable development.⁹³

⁹² Law passed on 27 April 1992

⁹³ Sustainable development is defined as a process through which the needs of this generation are satisfied without putting at risk the needs of future generations. Art. 2 Environment Law

Basing itself on the above, Bolivia participated in the Earth Summit where it promised to fulfill the agreements given that they coincide with the Bolivian change towards the operability of sustainable development.

- Current Situation

The state policies (PGDES 1997 – 2002) seek, within the context of the fight against poverty, to decrease the gaps between the rural and urban areas, between genders and generations, relating to the use of resources and the basic materials of society. For this four main areas have been selected to guide the ordering, outlining and giving of greater consistency to the process of sustainable development: Opportunity, Equity, Dignity and Institutionalality which seek to take the country on to higher levels of economic growth, while at the same time as strengthening local powers.

The Opportunity Pillar is based on the Strategic Nucleus of Large-scale Environment Management which overcomes pure conservationism by incorporating criteria of economic, social and political sustainability, tackling the management of natural resources in an integrated manner (the division between non-renewable resources and renewable is just convention) and is based on citizen participation.

This pillar also signals that “The instrumental policies for environmental quality management will have to be balanced with the international directives and agreements subscribed to by the country, adapting the mechanisms of application to Bolivian characteristics. Thus, the actions necessary to fulfill the UN Climate Change Convention will be promoted, adopting mechanisms to drive the adoption of environmentally clean technologies as well as the use of natural resources, taking care of the dynamic balance of the ecosystems and facilitating the organic response, based on technical knowledge, to the natural disasters caused by environmental degradation.

In this area, the necessary efforts to adopt measures aimed at the mitigation of climate change will be carried out. The processes, programs and projects aimed at achieving specific adaptation goals of the ecosystems to global climate change will be planned as well as the mitigation of greenhouse gases in the energy sector and others. Actions aimed at the development of and participation in the Clean Development Mechanism defined by the Kyoto Protocol to generate an important flow of added value from the conservation activities. All this work will be focused on achieving positive economic and social impact and will fall within the framework of a national climate change strategy.

Within the equity pillar, at least the following will be addressed in the area of education: primary education, technical training and education and company training. While the improvements in the education system are reflected in the AOP 1997 - 2002 in the following way:

- Improving the efficiency of the education system promoting education of a higher quality and for more people
- Improving the efficiency of the education services, increasing coverage and improving the number of hours worked by teachers

IV. NATIONAL EDUCATION REFERENCE FRAMEWORK

Bolivia, like other countries, is characterized by wide gaps in education that should be filled with the objective of gaining productive spaces and local or regional development enclaves that will create

their own economic and social strengthening. Given this reality the country has set out a series of measures encapsulated within the Education Sector Reform.

IV.A EDUCATION REFORM

The Education Reform Law (1565) was passed on 7 July 1994 initiating an education process to transform the Bolivian education system, incorporating the different ethnic cultures within the country (Interculturality and Bilingualism) and the promotion of national development (Popular Participation) through the transformation of the new generations.

These elements refer to: a) living active participation to parents in the different sections of popular participation (on school and other education boards) to strengthen, control and support the management and administration of education b) Interculturality and Bilingualism gives relevant strengthening and support to the meaningful learning by the children as main subjects of the NES. This component respects the cultural knowledge of the ethnic groups and peoples involved by using the mother tongue (L1) as the first language used in school and Spanish (L2) as the second.

The Education Reform stipulates that the Bolivian National Education System be divided into Formal, Alternative and Higher Education.

- *Formal Education*

We define formal education as the planned transfer of environmental knowledge, abilities and values within the Institutional Education System from preschool to secondary level that leads to the adopting of positive attitudes to the social and natural environment, which are translated into caring for and respecting the cultural and biological diversity, preventing damages to the environment and the climate, and fomenting inter and intragenerational solidarity.

Formal Education is aimed at the school-age population and is divided into preschool, primary (first to eighth grade) and secondary (first to fourth grade) primary is divided into three cycles: basic, essential and applied, whereas secondary education grades.

- *Alternative Education*

The Ministry of Education recognizes non-formal education (or alternative to the Education Reform) as the education system dedicated to adults, which is known as CEMA (Centro de Educación Medio para Adultos) or that dedicated to the teaching of technical skills to adults such as the Bolivian Learning Institute (IBA), These involve people who have not been able to attend or continue education within the Formal Education System.

In this framework we define non-formal education as the planned transfer of environmental knowledge, abilities and values including the climatic outside the traditional Institutional education System, especially dedicated to adults. This is currently made up of special education, Youth Education, Literacy Skills for Adults, Training of Human Resources, Technical Education and Permanent Education.

- *Higher Education*

This is post secondary education and the processes aimed at people becoming professionals, the permanent training of teachers and administrators, the formulation of policies and education guidelines based on the detection of needs from the local level, the strengthening of popular

participation in education through the training of the popular participation bodies. This is made up of the institutes of Further Education and Universities.

They are also in charge of the clustering of the Education Units to increase the cover and the retention of the enrollment. This process is generated through participation (between civil society and the different state institutions) uniting the Education Units by cultural identity, geographical area and access.

IV.B Characteristics of the National Education System (NES)

The NES is developed in related areas: institutional and curricular

IV.B 1a) Institutional Ambit

According to Supreme Decree 25232, the NES is divided into the following administrative levels:

- *Central Level:*

Generates the national policies and guidelines. It is made up of the different Ministry of Education, Culture and Sports departments.

- *Departmental Level*

Generates the departmental policies and guidelines, coordinates at the municipal education Level and is made up of the Departmental Education Service.

- *District Level*

This is the operative body of the NES; it belongs to the Municipality and is made up of Associated Education Units – education clusters. Within this administrative body are found the education staff, directors of schools, teachers, pedagogic assessors, students.

The different administrative levels operate according to the job descriptions set out in the NES legal framework for formal, alternative and further education, with the control, monitoring and supervision of further education corresponding to the departmental and national bodies.

IV.B .2Pedagogic Curriculum Ambit

This determines the guidelines and general content of the core curriculum and establishes the evaluation of learning to academia success rate.

- IV.B .2.1 Characteristics of the Curriculum

The legal framework of Law 1565 establishes that the subjects and contents of the curriculum within the formal and alternative education systems be divided into two areas; those related to the national core curriculum and the complementary branches that are formulated according to the educational and socio-cultural needs of the district and local levels.

- Characteristics of the Formal Education Curriculum

The common areas of the core curriculum are: mathematics, life sciences, technology and practical knowledge, expression and creativity, and ethics and morals.

Within the core curriculum, Law 1565 and its regulatory decree “Curricular Administration” establishes that:

The treatment of cross-cutting themes within the curriculum “serves to address the emerging problems of Bolivian society. The cross-cutting themes allow spaces for reflection on values and attitudes to be generated. These spaces work in the classroom on problems and contexts that have a negative effect on the social context.” For example, to tackle the cross-cutting theme of the progressive destruction of the environment, the cross-cutting themes of the curriculum can be used and linked within the different areas of the core curriculum.

There are various education resources to support the areas and contents established in the core curriculum:

- Learning corners
- Sets of students
- Classroom projects
- Classroom libraries

IV.B .2 Characteristics of the Alternative Education Curriculum

The subject matter is determined at a national level through areas divided by programs and areas of knowledge: economics and production, the environment and ecology, sustainable development, citizenship and democracy, art, recreation and sports.

At the local level, the contents of the cross-cutting themes are developed through the main subjects.

IV.B .3.1 The Treatment of Sustainable Development and Cross-cutting Themes

The Education Reform curriculum proposes that the treatment of all those contents and areas related to sustainable development should be dealt with within the curriculum’s cross-cutting themes, however the official documents do not have a clear definition or concept of what the treatment of cross-cutting themes is.

- **Sustainable development**

This does not only consider the protection and conservation of nature, but also constructs realities and a new social and economic development model that enables the individual and collective development now and in the future through the responsible management of natural resources.

It also takes in the existing relationships among the parts of the environment (human beings, plants, animals, the land, water, air), the problems that can cause inadequate management of them, the importance of sustainable management for individual, communal and country development bringing together local and western knowledge and internalizing sustainable management attitudes and abilities.

In this way the students will learn to value nature and take care of the materials.

- **Treatment of the cross-cutting themes**

The treatment of the cross-cutting themes within the education administration is developed in different ways:

In Formal Education

- Through knowledge in the areas of the core curriculum so that the scope of the academic knowledge can be measured
- Based on and satisfying the academic needs of the students. These learning processes – autonomous teaching in the classroom and/or Education Units, at least the pedagogic content and activities address the problem and the socio-educational context in each community, zone or region - become the significant learning for the student population.
- Through classroom projects. This is a supporting and participatory tool to be applied as a pedagogic work modality and organized based on certain contents of the different areas of knowledge in real-life situations.
- The pedagogic activity is planned, organized and functions as an objective or purpose agreed upon by the teachers and students, establishing educational facts outside or inside the classroom, school, neighborhood or community to be accomplished in a given time. This instrument enables learning to be efficient through group educational projects.
- The Group Educational Projects are school administration tools that are based on a group diagnosis (parents, students, school boards, school directors, education assessors and other social actors linked to the education system). They articulate, organize and carry out curricular management projects with the schools. The basis for which is a plan of action, activities and institutional or educational tasks (evaluation and administration) to be carried out during one or two academic periods.
- This instrument makes it possible for articulation within the Education Units and with the cluster of education needs in the territorial ambit of the Municipality. The Cluster Education Projects enable, through diagnostics, learning to be used and converted into concrete actions and articulate the cross-cutting themes based on local needs, examples, forestry projects, paper recycling, and the improvement of nutrition through corner stores.

Other instruments of education management and strengthening are:

- The contents of the curriculum as decided by the NES, which are developed for the training of teachers at the teacher training colleges.
- Within the municipal ambit, the objectives and goals (over a period of five years) that the Municipality should produce in educational materials based on diagnosis are set out by the Municipal Education Development Program (MEDP). This program respects and articulates, at the territorial level, the socio-cultural problems and the contents of the cross-cutting themes by defining guidelines and strategies to find a solution from the root of the problem. The MEDP is part of the MDP and also has a budget approved by the members of the Municipal Council.

Current situation of the Environmental Cross-cutting Theme

The application of the Education Reform with regards to the environmental cross-cutting theme is carried out based on “problematics” which should be set out for each education level to organize academic learning. The problematics for primary school are: the devaluation of the environment as a basis for life, the devaluation of traditional practices of managing natural resources, and the progressive destruction of the environment through human actions.

The results found up to now as regards the application of the environmental cross-cutting theme show the same deficiencies found throughout other branches of the Education Reform such as:

pedagogic deficiencies such as the large classroom numbers, or students of different levels in the same class that limit the adequate use of educational resources and the development of the theme.

The teachers' knowledge of the theme is also a problem when considering the application of the cross-cutting themes, as well as the primary level curriculum change, which has not been applied throughout the country. This limitation should be considered as part of the application process of the education reform and not as an initial failure.

- **The regulatory system**

The different legal instruments of the Education Reform Law establish how the National Education System administration should be developed in general. They set out regulatory decrees, yearly norms for administrative and curricular administration, school boards, decentralization, etc.

There are also regulations for school infrastructure according to the region, national guidelines with indicators developed to evaluate the advance of the education reform.

The programs developed for the national level are adapted for the different actors so that they can fulfill the decisions, lines of action and methodologies established.

There is an Annual operative Plan at the NES level, which is generated by the education units, the clusters, district and departments, that has annual goals held up by budgets and requirements to fulfill the demands made by the NES actors, e.g. staff requirements, materials, infrastructure, training, etc.

Education should generate and strengthen the development processes that do not compromise or contribute to the degradation of the environment, so the role it can play in the processes to reduce greenhouse gas emissions, mitigation and the adaptation of society to the effects of climate change, will only be possible if there is also a profound social transformation and change in cultural and economic patterns that are capable of changing the current, unsustainable model of development.

V INTERNATIONAL PROGRAMS, STRATEGIES, ACTIVITIES and ACTIONS IN EDUCATION AND COMMUNICATION FOR CLIMATE CHANGE

Global climate change is slowly being incorporated into the social, economic and technological development context and so the society needs to participate fully in decision-making having full access to and understanding of information about the factors that influence global climate change, how they are manifested and how society can adapt itself more effectively and/or limit future changes. However, the majority of the population does not know about or does not consider the impacts of climate change.

The national and international initiatives will depend on how important the environmental theme is in general and climate change in particular in the national and international context. It will depend also on the economic situation of the different countries and how severe the implementation of the international agreements for mitigation and reduction of emissions will have on their economy.

The degree of importance and the budget from a country or its institutions for education and research in general and specifically to climate change education should also be taken into consideration.

Below we will describe the education and research actions in climate change being carried out in some countries. These may be selected, adapted and applied in Bolivia according to their relevance, national reality and scarce budget resources.

V.A CANADA

Development of an Education Strategy on Climate Change

Learning for a Sustainable Future will build on the "Inquiries" series on sustainable development, currently used by teachers to educate student from grades five to eight. *The Climate Change Inquiries* will raise awareness and understanding of climate change while helping students make informed decisions for themselves and for their community. The series will include information on science, transportation, energy and the economy in both English and French and will be posted on the LSF Web site on School net. Other activities will include the organization of a series of 12 workshops for teachers across Canada and activities for students on climate change and sustainability, and production of a "Teacher's Guide" on these activities.

Canadian Communities and Climate Change: Tools for Action

Through its Building Sustainable Societies Program, the Harmony Foundation will provide innovative training and resource materials for community leaders and educators. *The Tools for Action* project consists of a Climate Change Leadership Training Session that will prepare community group leaders and educators to plan and deliver Community Action Workshops.

National Bill Insert Campaign

The Canadian Gas Association (CGA) will develop and produce customer bill inserts that will provide natural gas customers with factual background information on climate change, as well as energy efficiency tips to reduce their greenhouse gas emissions. The campaign is estimated to reach 3.5 million Canadians.

Greening Schoolgrounds (Trees for Kids)

Tree Canada Foundation provides leadership and promotes awareness, education and community action for the planting and care of trees in urban and rural Canada. *Greening Schoolgrounds (Trees for Kids)* is public outreach program that will provide educational materials and will help school boards across the country, plant trees, shrubs, etc. in school yards. It will demonstrate to teachers, students, and their communities that trees are an important part of climate change solutions. Schools and communities must match Tree Canada funding.

Canadian Alliance on Climate Change

Earncliffe Research and Communications will conduct a feasibility study and partner with industry to determine the viability of developing the Canadian Alliance on Climate Change. The Alliance will communicate the plans, efforts and results of the commercial and industrial sectors to reduce their greenhouse gas emissions and will demonstrate to Canadians through various communications activities that government and industry programs have achieved significant results and will encourage others to take action on climate.

Climate Change Education Program

This pilot education program is a comprehensive package of instructional resources on climate change that will be used by Canadian secondary school teachers and students. The program will address the basic concepts of global climate change and the associated scientific, political, economic, social, national and international issues. It too, will encourage critical thinking by students to develop strategies to respond to climate change. It will be available in both official languages and will include videos, transparencies and a teacher's resource guide to a Web site and CDROM.

Atlantic Projects

Climate Change Action: The Job Begins at Home

Climate Change Action: The Job Begins at Home is a pilot project that will deliver Home Green Up visits to 7,200 households conducted by seven Conservation Corps Newfoundland & Labrador youth-driven Green Teams. These home visits are based on the Green Communities model used in other provinces and will demonstrate to residents how they can reduce greenhouse gas emissions and energy and water consumption, divert waste from landfill and make informed transportation choices in their homes and communities.

Home Tune-Up Program

The Home Tune-Up Program will help homeowners identify areas and actions they can take on climate change in their homes and communities through greater energy efficiency, water conservation, more environmental transportation choices and other decisions that will help reduce the amount of solid waste they generate. Clean Nova Scotia will deliver 2,000 Home Tune-ups in the Halifax Regional Municipality over two years. The two-hour home assessment is designed to identify opportunities to reduce emissions and overcome barriers to action.

Halifax Transportation Options Program

The *Halifax Transportation Options Program* is a comprehensive transportation program that includes a public awareness campaign that will increase understanding of climate change and greenhouse gas emissions issues in the Halifax Regional Municipality. The employer-based pilot projects will target the reduction of single occupancy automobile trips through incentives. Employee pledges will identify barriers to change and will provide this information to municipal planners, community organizations and employers.

Annapolis Atmosfarm Outreach Pilot Project

The *Annapolis Atmosfarm Outreach Pilot Project* is part of an environmental management plan developed by Clean Annapolis River Project (CARP). The Atmosfarm Project aims to reduce greenhouse gas emissions and increase carbon uptake on commercial farms. As a result of using the uniquely diverse agricultural industry of the Annapolis Valley, CARP anticipates that methodologies and tools they develop will be transferable to other agricultural and rural areas across Canada.

Sustainable Transportation Initiative

As the only province without a public transportation system, the Environmental Coalition of Prince Edward Island has developed the *Sustainable Transportation Initiative*. The initiative will identify barriers to alternative modes of transportation; develop materials to raise awareness of transportation issues; encourage the use of alternative methods of transportation; establish a PEI ride sharing network; offer Island businesses energy use assessments of workplaces and vehicles and provide recommendations on the reduction of energy use; and hold a one-day car emissions

testing clinic in Charlottetown.

Retrofitting for Climate Change

Retrofitting for Climate Change will focus on reducing greenhouse gas emissions and energy use via housing retrofits. The Annapolis Valley Homebuilders Association will carry out 300 energy audits and provide information to homeowners on the benefits of energy efficiency retrofits as well as alternative energy options. For every energy audit that is completed, 20 trees will be donated to local reforestation programs to replace the estimated number of trees that go into building an average house and to demonstrate the benefits of trees in carbon uptake. The Association will also carry out a public awareness campaign, which includes interactive computer displays that will be shown at home shows and workshops, as well as newspaper articles, television programming, and a web site.

Quebec Projects

Bilingual Television Clips on Climate Change

A series of two-minute film clips on the various aspects of climate change including science and technology developments will be created for television networks, speciality cable and community stations. Over a three-year period, the clips are expected to reach eight million Canadians weekly.

A Fragile Climate

A Fragile Climate is a bilingual traveling exhibition designed to inform and educate Canadians about climate change and the importance of individual actions in reducing greenhouse gas emissions. The exhibition is scheduled to visit museums and exhibition centers across Canada over two years and reach an estimated 500,000 Canadians.

Pilot Project for a Community-based Energy Efficiency Program

The City of Laval, Quebec, in collaboration with Négawatts Production Inc., will develop and implement a community-based energy efficiency program targeting the residential sector. The pilot project will consist of an information program for community groups and schools, and home visits that will inform people about energy efficiency measures and transportation issues. The results of the pilot will be used to refine the model for delivery of the program to the entire community.

Ma Planète

Fondation québécoise en environnement will develop, produce and distribute *Ma Planète*, a bilingual educational kit on climate change, geared to secondary school students. The Kit will use an interactive CD-ROM format and will be supported by a Web site. The design of the CD-ROM is based on a virtual reality scenario featuring time travel where students, on a mission to fight against climate change, become heroes and at the same time gives them the knowledge to better understand climate change.

Decentralizing Energy Budgets to Educational Institutions

The goal of the Commission scolaire de la Rivière-du-Nord is to decentralize their energy budget as a means to realize a 10 percent reduction of greenhouse gases emitted by each of the Commission's 47 schools or buildings. Each building will be engaged in technical reviews, creation of an energy budget, implementation of energy programs and retrofits.

Éco-collectivité - Green Home Visits

Éco-collectivité - Green Home Visits is a pilot project geared to helping homeowners in the Montérégie area identify measures they can take to reduce their greenhouse gas emissions. The project includes 350 home visits; installation of energy and water saving devices that will reduce energy and water consumption in these homes, and reduce wastes destined for dump sites.

Educational Tour on Climate Change

Meteorologists from the Association professionnelle des météorologistes du Québec inc. (APMQ) will give 500 presentations on climate change to 15,000 students aged 12 to 15 years in Quebec schools. Activity books will be distributed at the presentations, which will also be made available to community and youth organizations.

Transportation and the Environment Summit

The *Transportation and the Environment Summit* comprises a series of round table discussions and lectures for individuals, organizations, associations and private companies on a variety of transportation and environmental issues, including reduction of greenhouse gas emissions. The information collected from these discussions will form the basis of a summit on transportation and the environment in May 2000.

Energy Efficient Neighbourhoods

Eco-Action will conduct workshops, telephone surveys and public information sessions to educate the residents of Montreal on the impacts of using fossil fuels on the environment and their health. Eco-Action will also conduct 400 home visits where they will provide recommendations to residents on reducing their household's energy and water consumption.

Pilot Project - Planting Trees in Schoolyards

Plantation d'arbre&'les cours d'école is a pilot project that will encourage students and schools to plant trees in their school yards and communities and will use the opportunity to demonstrate the benefits tree planting has on air quality and climate change for individuals and their communities. The project offers technical support, such as establishing planning committees, and distributing tasks and work plans for integrating the project into the teaching curriculum.

Ontario Projects

Combining Green Home Visits, Community Based Social Marketing and Transportation Demand Management to Reduce Greenhouse Gas Emissions

This project, developed by the EnviroCentre, aims to reduce greenhouse gas emissions by engaging people in activities that result in more resource-efficient, healthier homes and communities throughout the Ottawa region. By raising awareness and understanding of cost-effective transportation demand management and social marketing techniques in residential and workplace settings, the EnviroCentre will develop and distribute information to encourage individuals to adopt alternative modes of transportation. The results of this integrated community program will be a Catalogue of Social Marketing Tools for Energy Conservation in Canada and a Social Marketing Manual for Green Home Visits and Transportation Demand Management Programmes to be used by other communities in Canada.

Connecting Climate Change to Local Environments along the Great Lakes

The Lake Huron Centre for Coastal Conservation will develop an education kit and Web site on climate change and the possible impacts to the Great Lakes. The kit is designed to help elementary

school teachers bring climate change into their classrooms and illustrate the relevance of the issue at the community level.

No Energy to Waste

The *No Energy to Waste* project will pilot energy management initiatives at the store level with approximately 15 Toronto neighbourhood retailers. Energy audits will be conducted and retailers will be encouraged to act on the energy management options that are recommended from the audit. The project includes facilitating the development of incentives, services and programs to address and overcome barriers to retailer participation in energy management initiatives and to promote "atmosphere-friendly" environmental citizenship.

Climate Change Information and Awareness Workshop

In April of 1999 a public awareness workshop was held for communities throughout the Bay of Quinte region to inform participants of the possible impacts of climate change on the local ecosystem. Areas of impacts include municipal infrastructure, agriculture production, industry, commerce and the general public.

Climate Change: Meeting the Challenge

Climate Change: Meeting the Challenge is a two year project that will publish seven new articles and teaching activities about climate change in Green Teacher magazine and update existing climate change articles. These articles along with the updated versions of previously issued articles will be published together in a new curriculum guide that will be available in English and French. Every school in Canada will receive a copy of the guide.

Prairie Projects

Climate Change Interpretive Centre

The Fort Whyte Centre is creating the *Climate Change Interpretive Centre* and will develop education programs and interactive demonstration projects to help youth and adults understand issues surrounding climate change for individuals and their communities. They expect to reach 50,000 students and 100,000 general public visitors annually.

Going to Extremes!

Going to Extremes! is a collaborative project between Sierra Club and the Evergreen Theatre. It is an interactive theatre presentation designed to motivate students to take action individually and in their communities to reduce greenhouse gas emissions. The production will be presented throughout Alberta and will target about 16,000 students in grades 7 to 9.

Carbon Emissions Reduction and Trading in Alberta's Forest Products Industry

The Boreal Wood Centre and the Forest Products Association collaborated to develop a seminar and information program to increase awareness of carbon emissions trading opportunities among forest industry executives and managers of national and provincial climate change processes. The seminar was held in June 1999.

British Columbia Projects

Environmental Investment Fund

With assistance from the CCAF, an *Environmental Investment Fund* will be established based on

voluntary annual contributions from B.C.-based motorists and fleets. The fund will be used to invest in transportation-related and other projects that reduce greenhouse gas emissions.

Northern Project

Climate Change Poster for the Western Northwest Territories and Yukon Territory

Aurora College in Inuvik, NWT will develop a poster that provides information on climate change and will highlight issues specific to the biophysical and socio-economic environments of the western Northwest Territories and Yukon Territory. The poster will highlight information on actions to adapt to potential impacts and reduce greenhouse gases. It will be available in English and French and major Aboriginal languages of that region and will be distributed to secondary schools, local governments and community groups and will also be available on request.

V.B EUROPE

In Europe the themes related to climate change (in the majority of the cases) are found within a wider framework such as Global Change. Below are described some of the education initiatives in this field:

- **Economic and Social Research Council (ESRC) Global Environmental Change Programme**

This research program belongs to the University of Sussex, Falmer, Brighton, England and was set up in 1991 to offer social and economic sciences the experience obtained from global environmental research. The program addresses:

- The social and economic causes of environmental change
- The policies and strategies that governments, companies and individuals can adopt to mitigate or adapt to the impact of environmental change
- How environmental knowledge is related to these actions

- **European Networks on Global Change Research (ENRICH)**

The objective of ENRICH, dependent on the European commission in Brussels, consists of obtaining the most coherent European contributions to international research on climate change.

- **Global Climate Change Information Program (GCCIP)**

The Global Climate Change Information Programme (GCCIP) was established in October 1991 with the express purpose of providing the necessary information link between scientists (both natural and social), politicians, economists and the general public.

- **The International Global Atmospheric Chemistry Project (IGAC)**

International Geosphere – Biosphere Program, Royal Swedish Academy of Sciences

The IGAC goals are:

- To accurately determine global distributions of both short and long lived chemical species in the atmosphere and to document their changing concentrations over time.

- To provide a fundamental understanding of the processes that control the distributions of chemical species in the atmosphere and their impact on global change and air quality.
- To improve our ability to predict the chemical composition of the atmosphere over the coming decades by integrating our understanding of atmospheric processes with the response and feedbacks of the Earth System.

- **Land Use and Cover Change (LUCC)**

Barcelona – Spain

Over the coming decades, the global effects of land use and land cover change (LUCC) may be as significant, or more so, than those associated with potential climate change. Unlike climate change per se, land use and cover change are known and undisputed aspects of global environmental change. These changes and their impacts are with us now, ranging from potential climate warming to land degradation and biodiversity loss and from food production to spread of infectious diseases.

The importance of interdisciplinary perspective on LUCC was recognized early in the development of the LUCC Core Project, and is manifested in its joint sponsorship by the IGBP and the IHDP. From inception the planning and implementation of the project, has actively engaged both the physical and social science communities, and this will continue to be an important *modus operandi* in the future.

- **UK Global Environmental Research Office (GER)**

Swindon, UK

The Global Environmental Research Office was established in 1990 in recognition of the growing national and international interest in GER issues and the need to coordinate UK responses to research opportunities and challenges across Research Council disciplinary boundaries.

The GER office mission is:

- Provide a national focal point for the GER interests in the UK
- Collect and disseminate information on the development of the UK and international sciences and policies
- Promote a multidisciplinary team within the GER and its role to debate on the UK Research Council through relationships with governmental and non-governmental organizations and to organize thematic agreements, seminars and workshops.

V.C. AUSTRALIA

- **Commonwealth Scientific and Industrial Research Organization (CSIRO)**

Canberra, Australia

CSIRO serves the Australian community through results to provide:

- Benefits to the Australian industry and economy
- Environmental benefits for Australia

- Social benefits for the Australians
- To contribute to the Australian and international objectives
- To seek excellence in science and technology and in the provision of assessment and services

V.D THE UNITED STATES OF AMERICA

- **The Earth System Science Community (ESSC)**
Funded by: NASA, IITA, HPCC

The Earth System Science Community (ESSC) is a unique collaboration of educators, students, and scientists who are refining an investigation-oriented Earth system science curriculum -- and enabling high school and university students to research the Earth system using data and information via the Internet.

With ESSC, students and educators learn how to investigate the Earth as a system using the appropriate scientific data, tools, and techniques. Students also learn how to evaluate and publish the results of their team research on the Web. And because Earth system science is inherently cross-disciplinary, the materials, tools, teaching resources, and examples of student research -- all available from ESSC's Web site -- may be used to supplement existing curricula in Earth and environmental science, physics, chemistry, and beyond.

- **Environmental and Global Change Research at the National Science Foundation**

United States Government

The National Science Foundation (NSF) participates in and contributes to the US Global Change Research Program. This integrated research effort was set up in 1990 and is aimed at addressing global change, including its cumulative effects on human activities and natural processes on the environment, and to promote discussion among the international gents on global climate change.

The NSF contributes through basic research in all areas of science – atmospheric, land, ocean, mathematical, biological and social. The NSF also supports other fundamental work related to environmental research on the biodiversity and the function of the ecosystem, natural reduction and environmental technology.

- **Global Change Data Center (GCDC)**

Nasa/Goddard Space Flight Centers Earth Sciences Directorat, Greenbelt MD

The [mission](#) of the Global Change Data Center is to develop and operate data systems, generate science products, and provide archival and distribution services for earth science data in support of the [U.S. Global Change Research Program](#) and the [NASA Mission to Planet Earth](#).

The final aim of the GCDC is have data to support research, education and public policies.

- **Global Change Data and Information System (GCDIS)**

United States Government

GCDIS is an information collection and distribution system operated by governmental agencies involved in global change research. GCDIS provides global change data to scientists and researchers, policy makers, educators, industries and the general public. The GCDIS includes multidisciplinary data on atmospheric sciences, ecology, oceanography as well as economics and sociology. GCDIS is a joint venture of the agencies that participate in the American Global Change Program.

- **The U.S Global Change Research Information Office (GCRIO)**

The GCRIO provides access to data and information for research on global change, adaptation/mitigation strategies, technology and education recourses related to global change.

- **The Globe Program**

United States Government

GLOBE is a cooperative effort of schools, led in the United States by a Federal interagency program supported by NASA, NSF, EPA and the U.S. State Department, in partnership with colleges and universities, state and local school systems, and non-government organizations. Internationally, GLOBE is a partnership between the United States and 102 other countries.

Globe students are the heart of a group of environment observers and report their findings over the internet. Scientists use the data and provide feedback to enrich the students' science education. Every day the images created by the Globe students are sent to the web so that other students and visitors can see their observations.

- **National Institute for Global Environmental Change (NIGEC)**

University of California, Davis

The National Institute for Global Environmental Change (NIGEC) was established by the [U.S. Congress](#) in the Energy and Water Act of 1989. The institute is operated for the [U.S. Department of Energy \(DOE\)](#) by the University of California under a cooperative agreement. NIGEC's [National Office](#) is hosted by the [University of California](#).

- **US Global Change Research Project (USGCRP)**

United States Government

The USGCRP was created by a presidential initiative in 1989 and formalized with the "global Change Research Act 1990". From then global change research has been maintained as a key scientific initiative to continue the improvement of scientific understanding of the earth system as a priority for the National Science and Technology Council Committee on Environment and Natural Resources.

- **US Geological Survey Global Change Research Program**

United States Government

National and international concern is growing about the global environmental change projections related to the increase of human activities, including greenhouse gas emissions. A main goal of the USGCRP is to provide acceptable predictions of future climate change and its effect. Therefore this program is to contribute with environmental documentation from the past

and the present, and geological, hydrological, geochemical and geophysical documentation of the processes adversely affecting the environment.

- **Center for Global and regional Environmental Research (CGRER)**

University of Iowa

The CGRER promotes multidisciplinary research efforts that focus on many aspects of global environmental change, including the regional effects on the natural ecosystems, resources and human health, culture and social systems. Members are anyone interested from the College or University of Iowa.

- **Climate Research Group (CRG)**

University of Illinois at Urbana-Champaign, Department of Atmospheric Sciences
The Consortium for International Earth Science Information Network (CIESIN)

University Center, Michigan

CIESIN was founded in 1989 as a private non-profit organization whose members are from universities and research NGOs to provide information for scientists, decision-makers and the general public to better understand the changing world. The Consortium was set up at the request of the US Congress board and is dedicated to the multidisciplinary study of global environmental change.

- **Enviro Link**

Pittsburgh PA

The EnviroLink Network is a non-profit organization which has been providing access to thousands of people from around 130 countries of online environmental resources since 1991. It joins together hundreds of organizations and volunteers around the world to provide complete information on all the available environmental resources.

- **Global Change**

University of Maryland, Center for Global Change

“Global Change” seeks to familiarize the public with themes related to climate change and the depletion of the ozone layer. As there are not sufficient resources, its future is in the balance.

- **Hawaii Sea Grant Global Change Education Home Page**

What exactly are [greenhouse gases](#)? How large is the [human population](#) right now? [What is ozone](#) and why should I care about it? To learn more about these subjects, or find answers to any other questions you have about sea level rise, global warming, biodiversity, ozone depletion, or other climate and global change topics, check out this page.

- **The Institute for Global Change Research and Education (IGCRE)**

Global Hydrology and Climate Center (GHCC) Huntsville, Alabama

Located in the (GHCC) in Huntsville, Alabama, IGCRE is an Institution operated by the University of Alabama in Huntsville and the Universities Space Research Association. It focuses on advancing understanding of the role of water and energy in the dynamics of climate change. The Institute also integrates research with science and earth system educational needs and

global change science to highlight the importance and challenges of global change science. The objective is to serve university research, the private sector and governmental science agencies.

- **Institute for Global Communications' Progressive Directory (IGC)**

San Francisco, California

This Institute serves to expand and inspire grassroots organizations working for peace, human rights, environmental sustainability, women's rights, conflict resolution and worker rights. IGC is a founder member of the Institute for Global Progressive Communications.

- **The National Center for Environmental Decision-Making Research (NCEDR)**

University of Tennessee

NCEDR provides officials capable of making decisions to the state, regional and local level, with the necessary information, techniques and processes to resolve environmental problems. In practice they have created spaces for researchers and workers in the improvement of environmental decisions to meet.

- **Program in Atmospheric and Oceanic Sciences (PAOS)**

University of Colorado

The PAOS is a multidisciplinary team that provides a research and educational environment to examine the dynamic, physical and chemical structures of the ocean and the atmosphere and how they work together. A major theme is to establish the physical bases to understand, observe and model the climate and global change.

- **Sea Grants Educational Resources**

Virginia Sea Grant/ Virginia Institute of Marine Science

Sets up connections with Global Change teaching resources

- **A.R.M Education Center Home**

Atmospheric Radiation Measurement is an important part of the U.S. Department of Energy. It functions as a strategy to understand global climate change. It has tools such as WebPages to explain what Atmospheric Radiation Measurement is, the advances and description of global warming, spaces to question scientists, weekly questions from website visitors, research games for children, lesson plans for teachers on climate change, related news, sites to visit and information from Professor Polar bear – the site pet.

- **Mission to Planet Earth**

NASA's Mission to Planet Earth (MTPE) is dedicated to understanding the total Earth system and the effects of natural and human-induced changes on the global environment.

- **Project Earthlink**

A National Oceanic and Atmospheric Administration and other American state organizations effort, that works in training, education and social awareness raising.

- **Junior Solar Sprint**

Junior Solar Sprint is a fun hands-on theoretical and practical educational program sponsored by the Department of Energy for middle school. Until now it has reached over 100,000 students and 15,000 teachers.

- **Global Change Teacher Packet**

The U.S. Geological Research Department has produced more than 20,000 copies of a Climate Change Teacher Packet. The material includes modules on the impact of greenhouse gases, geological time, environmental warming and the carbon cycle.

There are many more education and research programs such as:

- Project NOVA
- National Park Service's Olympic Exhibit
- Reporting on Climate Change: Understanding the Science
- DOD Initiatives
- DOE Regional Roundtables
- IREC's Park Power
- EPA's State and Local Climate Change Program
- Ocean Planet
- Energy Star
- Business Forum for Sustainable Development
- National Sustainable Development Extension Network
- School Construction Initiative
- State Capacity Building
- International Program

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