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ADAPTATION FUND

ENHANCING RESILIENCE TO CLIMATE RESILIENCE AND CLIMATE VARIABILITY IN THE DRY AND PANAMA CANAL WATERSHED

-CONCEPT NOTE-

FINAL DRAFT OF PANAMA´S CONCEPT NOTE TO REQUEST FINANCING TO THE ADAPTATION FUND

April, 2013

ADAPTATION FUND
PROJECT/PROGRAMME ID:
(For Adaptation Fund Board Secretariat Use Only)

DATE OF RECEIPT:

PROJECT PROPOSAL

PART I: PROJECT/ INFORMATION

PROJECT CATEGORY:	**REGULAR**
COUNTRY/IES:	
SECTOR/S:	
TITLE OF PROJECT/PROGRAMME:	**ENHANCING RESILIENCE TO CLIMATE CHANGE AND CLIMATE VARIABILITY IN THE CENTRAL PACIFIC REGION OF PANAMA (FOCUS ON DRY ARCH AND PANAMA CANAL WATERSHED)**
TYPE OF IMPLEMENTING ENTITY:	**MULTILATERAL IMPLEMENTING ENTITY**
IMPLEMENTING ENTITY:	**UNITED NATIONS DEVELOPMENT PROGRAMME, UNDP**
EXECUTING ENTITY/IES:	**NATIONAL ENVIRONMENTAL AUTHORITY (ANAM) IN COORDINATION WITH PANAMA CANAL AUTHORITY (ACP), MINISTRY OF AGRICULTURAL DEVELOPMENT; (MIDA) AND PANAMA´S ELECTRIC TRANSMISSION COMPANY (ETESA)**
AMOUNT OF FINANCING REQUESTED:	**US$ 6,077,284**

List of Acronyms

ACP	Panama Canal Authority
ANAM	National Environmental Authority
CATHALAC	Water Center for the Humid Tropics of Latin American and the Caribbean
CCA	Climate Change Adaptation
CDM	Clean Development Mechanism
CEPAL	Comisión Económica para América Latina y el Caribe
CEPREDENAC	Coordination Center for Natural Disaster Prevention in Central America
CHCP	Panama Canal Watershed
CICH	Institutional Commission of Panama Watershed Basin
CONACCP	Panama National Commission of Climate Change
CONACCP	Panama´s National Committee for Climate Change
CREHO	Ramsar Regional Center for Training and Research on Wetlands in the Western Hemisphere
Desinventar	National Disaster Database
DRM	Disaster Risk Management
DRR	Disaster Risk Reduction
ECLAC	Economic Commission for Latin America and the Caribbean
ENSO	El Niño – Southern Oscillation
ETESA	Electrical Transmission Company
FAP	Panama Savings Fund
FIDECO	Ecological Trust Fund of Panama
GEF	Global Environment Facility
GoP	The Government of Panama
HFA	Hyogo Framework for Action
IDAAN	Institute for National Water Supply and Sewers
IDIAP	Agricultural and Cattle Research Institute of Panama
INADEH	National Institute for Human Resources Development
MEDUCA	Ministry of Education
MIDA	Ministry of Agricultural Development
MINSA	Ministry of Health
NOAA	National Oceanic and Atmospheric Administration
NPDRR	National Platform for Disaster Risk Reduction
OMM	World Meteorological Organization
PAN	National Action Programme to combat Desertification and Drought
PCW	Panama Canal Watershed
PEG	Government Strategic Plan 2010–2014
PIEA	Environmental Economic Incentive Program
Plan DS-GIRH	Sustainable Development Plan and Integrated Water Resources Management of the Panama Canal Watershed
PMCC	Panama Canal Basin Natural Resources Monitoring Project
PNGIRD	Comprehensive National Policy on Disaster Risk Management
PRECIS	Providing Regional Climates for Impacts Studies
SINAPROC	National Civil Protection System
TEEB	The Economics of Ecosystems and Biodiversity
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme

UNFCCC	United Nations Framework for Climate Change
WatSan	Water and Sanitation
WMO	World Meteorological Organization

PROJECT / PROGRAMME BACKGROUND AND CONTEXT:

Provide brief information on the problem the proposed project/programme is aiming to solve. Outline relevant climate change scenarios according to best available scientific information. Outline the economic social, development and environmental context in which the project/programme would operate.

I. INTRODUCTION

1. According to the Natural Disaster Hotspot study by the World Bank, Panama has the 14th-highest economic risk exposure to multiple hazards, based on land area**.** Due to its geographic location and tectonic characteristics, Panama is exposed to a variety of natural hazards, especially those of hydrometeorological sources. Fifteen percent of Panama´s total land area, and 12.5%of its population are exposed and vulnerable to two or more hazards. In addition, Panama ranks 35th among countries with the highest percentage of total population considered at a relatively high mortality risk from multiple hazards.

2. Panama's vulnerability to the impacts of natural hazards is showing an increasing pattern characterized by a higher physical exposure of people, goods, and services, compounded by extreme climatic variability conditions. The Prevention Web site1 reports that Panama experienced 38 major natural disaster events between 1980 and 2009, which caused an estimated US$96 million in economic damages. Two hundred seventy-six people were killed and 279,712 people were affected. These figures, however, do not take into account the cumulative effect of recurrent low-intensity hydrometeorological events that frequently affect the country. According to Panama's Disaster Information System (Desinventar)[2] database, which tracks data on the occurrence of adverse events disaggregated at local level, the country suffered 1,225 local adverse natural events between 1999 and 2009 that killed 103 people and affected 211,000. Over 80 percent of these events were hydrometeorological in origin, causing 72 percent of reported fatalities.

3. One strategic area on Panama's agenda is the response to the challenges posed by climate change. The Government of Panama (GoP) recognizes the need to devise an effective climate change mitigation and adaptation strategy with buy-in from the country's diverse groups of stakeholders and sectors—a strategy to facilitate the adoption of innovative technologies in the energy sector and agriculture, encourage private sector investment in clean technology, promote the use of renewable energy, sustainable land use, and reduced deforestation. On the adaptation side, priority areas are the reduction of vulnerability to natural hazards and climate shocks and the spread of vector-borne diseases.

4. The GoP has included climate change adaptation measures as a policy priority within its Government Strategic Plan 2010–2014 (Plan Estratégico de Gobierno 2010–2014, PEG), and emphasizes the importance of mainstreaming environmental protection in the sectoral planning processes. The PEG investment strategy considers activities related to the impact of climate change on the country's natural resources, including (a) implementation of climate change adaptation and mitigation measures, (b) capacity building in regards to climate change issues, and (c) the

[1] Prevention Web, Panama, Data and Statistics; http://www.preventionweb.net/english/countries/statistics/?cid=131, accessed May 2011.

[2] Desinventar is a methodology and information management tool that helps analyze disaster trends hydrometeorological, geophysical, and anthropogenic events that affect countries and their impacts. In Panama, the National Civil Protection System (SINAPROC) is responsible for maintaining the Desinventar database.

implementation of an action plan for climate change in Panama. Climate change threatens to increase vulnerability of both human and ecological systems in Panama. The agriculture, water resources, forestry, coastal zone management and health sectors will be particularly impacted. More frequent and intense storms, floods, and droughts are causing huge economic losses and affecting the livelihoods of the poorest and most marginalized members of society in particular.

5. Panama has developed a policy and programmatic framework to address the challenges posed by climate change. In 2007, Panama enacted a National Policy of Climate Change that aims at managing the issue and its effects at the national level, in conformation with international treaties and the national environmental law, and introduces a proposal for a Participatory Action Plan on climate change. This National Policy is currently being updated through a wide and inclusive participatory process lead by the Environmental National Authority (ANAM), taking addresses the harmonization of disaster risk reduction and adaptation to climate change, among other considerations. Additionally, the country has launched in 2011 its Second National Communication, which includes a whole chapter on adaptation to climate change, and has recently activated the Panama´s National Committee for Climate Change (CONACCP), created in 2009 to assist ANAM with implementation of the country's climate change policy There is a new decree proposal submitted by the Ministry of Economy and Finance and expected to be approved in first quarter of 2013, strengthening the multistakeholder composition of CONACCP with the explicit inclusion of civil society and private sector.

6. The recent enactment of a Comprehensive National Policy on Disaster Risk Management (PNGIRD) is considered a milestone in the evolution of the disaster risk reduction (DRR) agenda in Panama. A multisector participatory process gave birth to the PNGIR, which was enacted by Executive Decree No. 1101 on December 30, 2010. One of the five pillars of the adopted PNGIR explicitly addresses Climate Change Adaptation (CCA) as linked with disaster risk reduction (DRR) objectives and calls for the harmonization and identification of synergies between the disaster risk reduction and CCA national agendas. The DRR achievements by the GoP also include the development of a National Platform for Disaster Risk Reduction (NPDRR) in December 2005. In December 2005, the CEPREDENAC National Commission3 was officially recognized as Panama's NPDRR, according to the guidelines of the Hyogo Framework for Action (HFA). In October 2010, the NPDRR was expanded by incorporating additional members of Panama's civil society, government agencies, and NGOs, highlighting the country's commitment to mainstream and advance its disaster risk management program, through a more proactive and participatory mechanism. The National Platform for Disaster Risk Reduction (NPDRR) is playing an increasingly important role in mainstreaming DRM activities in the country. ANAM and the Hydro-meteorological Service of ETESA are active members of the National Platform.

7. In line with these recent developments on the policy and programmatic arenas for Climate Change and Disaster Risk Reduction, and with the aim of reducing the increasing vulnerability to climate change and variability in the country, the GoP engaged in a participatory process towards the development of this proposal for the Adaptation Fund**.** The proposal is focused on two critical areas in the Central Pacific Region of Panama, which has been prioritized according to its vulnerability to climate change and climate variability. The eventual approval of this proposal would represent a

[3] Panama's CEPREDENAC National Commission was established by Executive Decree No. 402 of November 12, 2002. The National Commission is composed of the General Director of SINAPROC, who presides; and the ministers of Agricultural Development; Economy and Finance; Education; Foreign Affairs; Health; Housing; Public Works; and Social Development; the National Environmental Authority (ANAM); the Social Security Administration (CSS); the Faculty of Civil Engineering of the Technology University in Panama; the Institute of Geosciences of the University of Panama; and the Panama Canal Authority.

significant step for the implementation and consolidation of the new policy and programmatic frameworks for the integrated approach on disaster risk reduction and adaptation to climate change in the country.

II. CLIMATE VARIABILITY AND CLIMATE CHANGE CONTEXT IN PANAMA

8. The emergence of the Panamanian isthmus 3.1 to .35 million years ago not only united North America and South America, but also separated the Pacific Ocean from the Caribbean Sea, greatly contributing to global climate modification and an increase in planetary biodiversity.[4] The climate regime is defined by the tropical latitudes, with two seasons defined by rainfall patterns: dry season (January to May) and a rainy season (April to December) and a short period of midsummer drought known as "canicula" in July. A long rainy season brings 250 to700 millimeters of rainfall across the country and historical values reflect wide temperature uniformity during the year. The average annual temperature ranges between 24 ° C and 28 ° C although maximum temperatures have been registered in April and the lowest in December and March. In the highlands, the average temperature is 18 º C. In recent decades the mean temperature shows a continuous and a trend towards warmer conditions and less moisture in the atmosphere.

9. Panama has three pluviometric regions: a) The Cordillera Central and North Eastern Arc (Central Region of the country). Those divide the Isthmus into two regions, Pacific and Atlantic, according to rainfall. The annual precipitation of the Pacific region is of an average of 1,500 mm to 3,500 mm, with a dry season between December and late April and a rainy season among May and November. The central region has a moderate rainfall due to strong prevailing flows from the Pacific or the Atlantic. The precipitation in the Atlantic region is distributed throughout the year, without a clear dry season differentiated and abundant rainfall exceeding 4,000 mm annually. Between December and February heavy rainfall may occur, caused by the incursion of fronts from the Northern Hemisphere, while between March and November rains are caused by the influence of winds laden with moisture from the Caribbean.

10. The country is frequently affected by hydro-meteorological events, such as droughts, floods and landslides, while several areas exhibit severe conditions, prone to soil and environmental degradation (the Dry Arch, the *Sabana Veraguense*, the *Corregimiento of Cerro Punta* and the *Comarca Ngöbe Buglé*). Hydrological studies show that during ENSO events, there is a decrease in the levels of the artificial lakes that feed the Panama Canal system and the droughts tend to exacerbated, or more frequent, under the influence of such phenomena. During the 1982–1983 and 1997–1998 ENSO events, severe droughts affected the Panama Canal watershed and caused ship draft restrictions. The latest of drought events occurred in July 2012, in three districts of Los Santos Province affected by a severe drought with negative impacts on rain-fed crops, pastures and other livelihoods and sectors leading the Government to declare a State of Emergency[5].

11. During the last decade floods led to significant problems for the agricultural sector in Panama and are increasingly affecting urban areas as well. Between 2000 and 2006, floods had the highest human and economic impact in Panama. As many as 62,678 people were affected by eight major events of flooding, with the cost of damages reaching US $8.8 million[6]. In December 2010, intensive rainfall across Panama caused widespread flooding, forcing the temporary closing of the Panama Canal due to unprecedented water levels in the artificial lakes, reaching their highest levels ever recorded. Official sources established that Panama needs US$149.3 million to repair damaged

[4] Panama Second National Communication, ANAM, 2012.
[5] Gazeta Oficial. Executive Decree No. 630, 25 de Julio de 2012.
[6] World Bank. Panama. Country Note on Climate Change Aspects in Agriculture. December 2009.

infrastructure and restore economic activity in the areas affected by those events[7], while in November 2012, heavy precipitations, caused floods and landslides in Colon, the Caribbean region and Western Panama. The National Government declared a State of Emergency and the Congress approved the implementation of the Panama Savings Fund (FAP), in order to divert from it, up to 500 million in funds from the FAP, to help flood victims and to re-build damaged infrastructure.

12. Climate change threatens to increase vulnerability of both human and ecological systems in Panama. Due to the exacerbating effect of climate change, the frequency and intensity of extreme weather events of the climate variability — including the El Niño Southern Oscillation (ENSO) — are expected to rise. Therefore, tropical storms may have stationary phases over the Panamanian territory for prolonged periods, causing major floods and triggering landslides and impacts over agriculture, water resources, forestry, coastal zone management and health sector. More frequent and intense storms, floods, and droughts are causing huge economic losses and in particular are affecting the livelihoods of the poorest and most marginalized members of society.

13. Studies such as the First National Communication for the UNFCCC highlight the gradual and permanent flooding of lowlands, in addition to the increase of the already active erosive processes in coastal areas and dead cliffs for Panama's coastal zone (as the most obvious consequence of climate change in the country. Ongoing studies of coastal and marine vulnerability in the Pacific and Atlantic slopes are aiming to generate future scenarios of sea-level change for the country.

CLIMATE SCENARIOS: IMPLICATIONS FOR DISASTER RISK MANAGEMENT
• Given the expected variability in precipitation, it is crucial to improve water storage capacity to utilize excess water from wet years. • Increased periods of high temperatures might produce recurrent heat waves that could create severe health impacts including the proliferation of diverse pathogens, increased dehydration and other respiratory diseases. • After 2015, the threat of climatic variability is most likely to begin to be the principle driving force behind the risk of an increased tendency of greater extreme events. This would require integrated assessments and development planning that closely integrates disaster risk planning and climate change adaptation, in particular for food security, energy access, and overall sustainable development. • The poorest populations, including vulnerable indigenous populations, will not, and indeed, cannot, adapt if this will require looking beyond their immediate food security needs. The potential impacts of climate change on Panama most vulnerable population should be prioritized.
Source: Panama´s Climate Country Adaptation Profile (The World Bank, 2012)

14. Results of climate trends for 2080 showed a greater increase of mean annual precipitation under the A2 scenario of climate change while precipitation showed an 80% percent overall increase, which may go up to 60%-70% in January, April and May. Model projections remain uncertain but it is clear that future climate will increase in variability and intensity of extreme events. However, the number of extreme precipitation events is expected to decrease by 2080 according to a downscaling study (PRECIS), so extreme precipitation events (greater than 40 mm per day) are expected to decrease in about half of current amounts under the A2 scenario of emissions. The expected increase in sea level rise might reach 35 cm by the end of this century[8].

[7] "Dirección de Presupuesto de la Nación. Informe Solicitando la Dispensa de los Límites Financieros por Emergencia Nacional," Ministry of Economy and Finance, March, 2011.
[8] ANAM, 2012

Temperature	projected to increase for the dry season	0.4°C to 1.1°C by 2020 ▲ 1.0°C to 3°C by 2050 1.0°C to 5.0°C by 2089
Rainfall	uncertainties in projections for dry season rainfall	-7% to +7% by 2020 ▲▼ -12% to +5% by 2050 -20% to +9% by 2080

15. Based on ECLAC (2010), several models have shown a consistent trend of increase in temperature for Panama (Figs. 1-3) over timeline periods, based on data between 1950 and 2006 and scenarios A2 and B2 of climate change[9]. The results highlighted a general increase in temperature during summer, both for scenarios A2 and B1. That increase is projected to be between 0.5°C to 1°C and 1°C to 2.5°C respectively. The change tends to be more evident in the central and western provinces, including Panama Province, approximately around 2020. However, approaching 2050 and mostly near 2080, the temperature increase under A2 appears to reach values of 1.5°C to 4.5°C while under B1 it raises only between 0.7°C to 2.6°C for the same period[10].

Panama: registered and projected changes in temperature (1950-2100)

Fig.1. Annual average temperature, 1950-2006

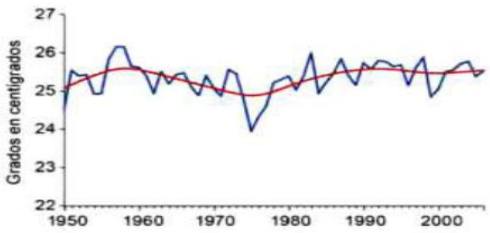


Fig.2. Annual average temperature, scenario B2, 1960-2100

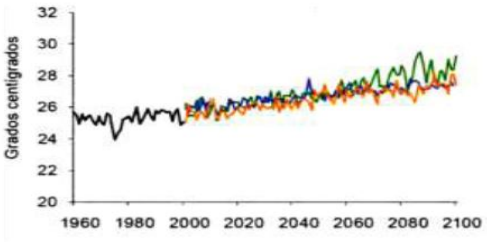
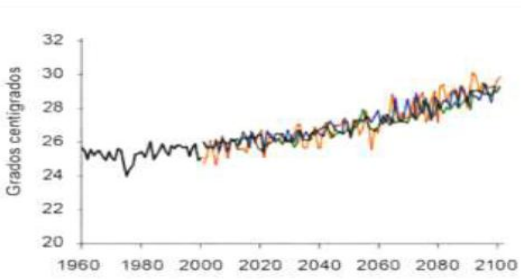


Fig.3. Annual average temperature, scenario A2, 1960 – 2100



Source: ECLAC, 2011

[9] II National Report to the United Nations Framework for Climate Change (UNFCCC)
[10] Ibidem.

16. Panama's First National Communication to the United Nations Framework Convention on Climate Change (UNFCCC) identified the sectors most sensitive to climatic change: agriculture, water, coastal-marine systems, health and forests, with the first three highlighted as particularly vulnerable. The First Communication included vulnerability assessments of the water sector on the Chagres and La Villa Rivers based on the reduction in water flow of 1-4% by 2010; 6.26% by 2050 and as much of 40% less in the Chagres river by 2100[11]. The adaptation measures suggested by such studies include the strengthening of water and weather station network to allow better prediction of future changes in the water regime (floods, droughts); the development of new irrigation technologies and the conservation and rational use of water resources supported by research on scientific hydrology and climatology and finally, the identification and use of renewable energies. The Second National Communication identified energy as the most sensitive sector but also, agriculture, coastal - marine, forestry, human health and water resources.

SUMMARY OF SECTORAL IMPACTS *(Based on the Second National Communication to the UNFCCC)*	
Sector	***Impacts***
Agriculture	Several crops affected by water and temperature stress, including corn. Studies of future yield trends for irrigated and non irrigated rice show that both are likely to decrease. The underlying effect of temperature rise and recurrent droughts may expose soils to severe desertification in the Dry Arch Area and other semiarid regions.
Water resources	Disasters and extreme damage events associated with climate change and inter-annual climate variability – including ENSO - expected to influence more frequent droughts and water scarcity. ENSO events may cause reductions of as much as 20% on river levels, which is likely to worsen due to climate change.
Coastal Resources	18 cm of sea level rise for the past 50 years along the Pacific coast of Panama supports projections of a constant increase of approximately 1.3 mm/year and this is anticipated to accelerate in this century
Human Health	Increase in some kind of illnesses such as certain forms of cardiopulmonary syndrome, acute diarrheic episodes, respiratory and vector-related illnesses (dengue and malaria) are expected to rise, based on morbidity statistics of MINSA likely to be associated to changes in climate patterns.

17. Although the most obvious consequence of sea level rise will be the gradual and permanent inundation of low-lying areas and a variance to the current coastline, other impacts refer to increased salinity in estuaries and in underground water supplies including freshwater aquifers; more frequent flooding by storms, altered patterns of sedimentation increasing turbidity and thus decreasing of the amount of light reaching the river bottom or seabed. Fig. 4 highlights the threat of set back and higher sea levels in the area of the Dry Arch.

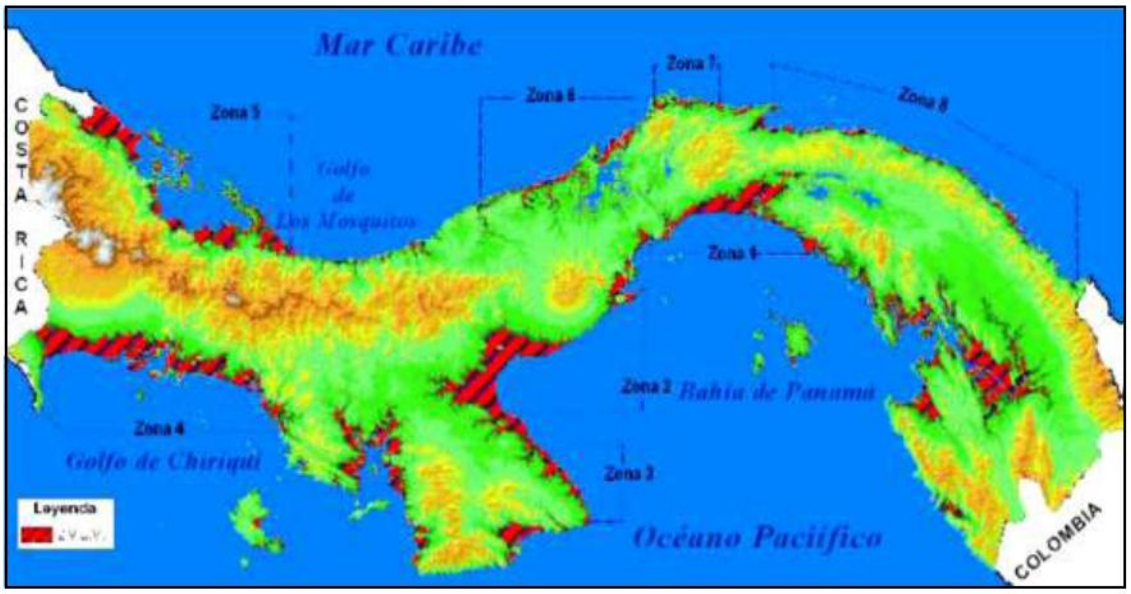
18. In relation to water resources, both scenarios - A2 and B2 - for Panama, appear to unfailingly suggest a reduction of not less than 20,000 m^3/ year compared to the baseline scenario and which could be as much as 40,000 m^3/ year[12]. Notice how the total demand increase tends to go up in time according to real data, and not significantly different from projections under A2 and B2 (Fig.5). As well, figs. 6 and 7 highlight the condition of Panama, where water demand is already over 20%,

[11] ANAM, 2000

[12] ECLAC, 2010.

which indicates water stress. Under A2 and B2 scenarios, this condition is expected to keep getting wors

Fig. 4. Coastal zones vulnerable to sea level rise in Panama



Source: ANAM, 2011

19. Most adaptation projects in the country are focused on building capacity to cope with climate change impacts[13], while data information and research gaps still need to be addressed (see list below). This is especially of note considering that significant numbers of climate change expert communities are calling for broad based recalculations as models used are repeatedly demonstrating to have underestimated the rate of change.

Data Information Gaps	Research Gaps
• Coverage of early warning systems, weather forecast technology and more modern communication systems targeting local levels, especially for long-term forecasting. Capacities and technologies for climate modeling • Training and awareness-raising on climate change threats and climate-resilient development regarding livelihoods depend on climate-sensitive sectors. • Coverage of the national network of meteorological stations, as those available currently provide uneven patches of data density, with an average of 312 km^2 per station, in comparison with the recommend standards of the OMM of 20 km^2.	• Access and validation of hydrometeorological data as well as translation of climate data into meaningful information at the sector level. • Quality and scope of scientific research that evaluates associated impacts of the El Niño and La Niña to vulnerable sectors.
Source: Panama´s Climate Country Adaptation Profile (The World Bank, 2012)	

[13]IISD, Adaptation Partnership, 2011. Review of current and planned adaptation action in Mexico and Central America.

Fig. 5. Evolution of total demand of water regarding baseline and scenarios A2 and B2, for the period 2000-2100

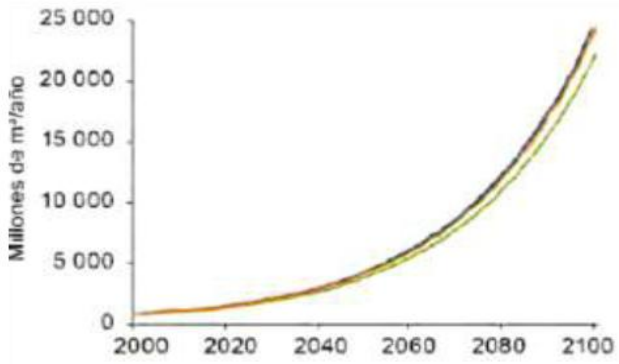


Fig. 6. Panama: Evolution of use of water intensity under baseline and A2 scenarios, 2000-2100

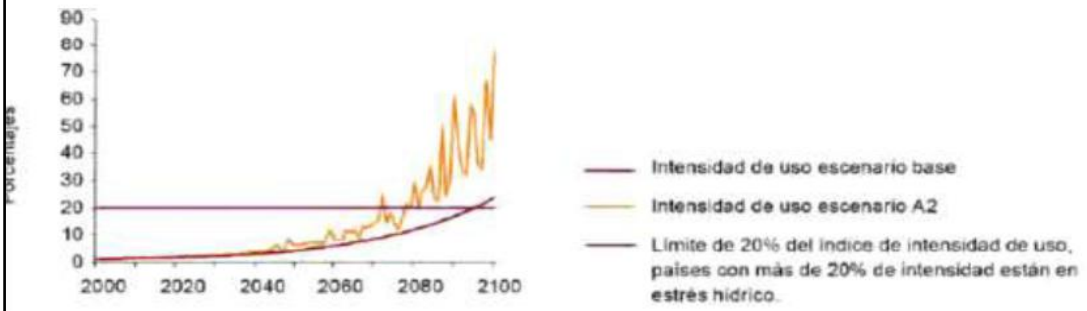
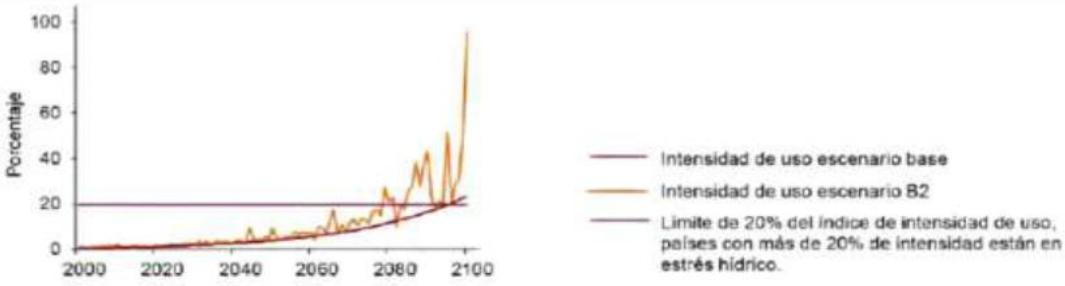


Fig. 7. Panama: Evolution of use of water intensity under baseline and B2 scenarios, 2000-2100

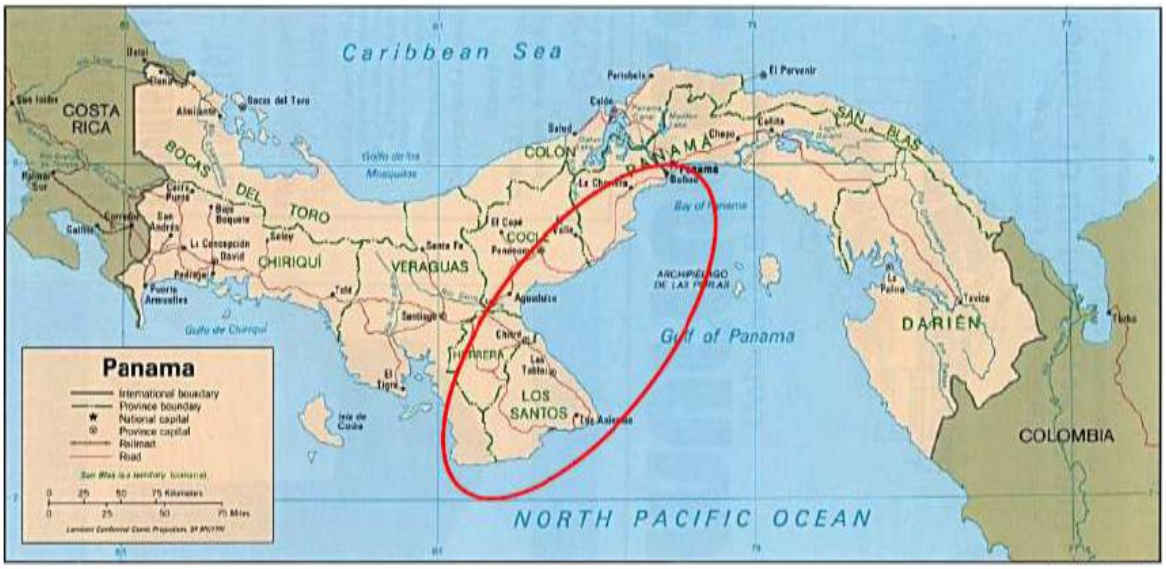


III. TWO TARGET INTERVENTION AREAS IN THE CENTRAL PACIFIC REGION OF PANAMA

20. The two geographical areas prioritized for this proposal are located in what is known as the Central Pacific region of Panama, composed by the Province of Los Santos and most part of the Province of Herrera, central and south sections of the Province of Coclé and the south segment of the western section of the Province of Panama, as well as the urban basin of the Juan Diaz's river. This entire area drains to the Ocean Pacific and its basins are characterized by less precipitation than others within the country. The rainfall here averages between 1000 – 2000 mm per year[14].

21. The area known as the **Dry Arch**, which includes the basin of the Santa Maria River[15] is located within this Central Pacific Region. The Dry Arch was one of the two critical regions prioritized by the National Government[16]. The Central Pacific Region also includes a sector of the vital **Panama Canal Watershed**, which covers the most populated area of country.

Fig. 8. Map of Panama (the central Pacific region is located inside the red oval)



22. It is important to highlight that the available climate change scenarios for the country are focused in the Central Pacific Region of Panama, where the proposed target intervention areas are located. Indeed, one of the most important studies on vulnerability to climate change in Panama was developed for the Santa Maria river basin, located in the Dry Arch. This study provides the basic future vulnerability trends in the country regarding adaptation measures for water resources. In addition, a recent climate vulnerability evaluation of this Panama Canal Watershed has been delivered recently and has allowed the identification of the most vulnerable areas and communities, which are included in this proposal.

[14] ANAM, 2009. Atlas de las tierras secas y degradadas de Panamá. Autoridad Nacional del Ambiente, Gobierno de Panamá.
[15] ANAM, 2010. Cuarto Informe de Panamá ante el Convenio sobre la Diversidad Biológica. Gobierno Nacional de Panamá, UNEP, ANAM.
[16] ANAM, 2004

Climate vulnerability in the Dry Arch

23. The Dry Arch includes the eastern plains and hills of the provinces of Los Santos and Herrera, and the southern coast of Coclé. To the north it borders the Central Mountains of Panama, to the south, the Pacific Ocean, to the west, the Macizo of Azuero and to the east, the Gulf of Panama. More specifically, it includes the territories between the low basin of the Tonosi River, the middle and low basin of the Guar are river – in Los Santos -, and the La Villa, Parita and Santa Maria rivers, in the Herrera province and the Grande and Anton rivers in Coclé. The surface of this area is 10.708,03 km2 and its population is 263,624 (ANAM, 2010, quoting the National Population Census of 2000)[17].

24. From a cultural perspective, this region is known as "Gran Coclé" and has innumerable microhabitats, including the *sabana*, profusely disseminated within the area. Even though in the Central Mountains of Panama, rainfall is of 7,000 mm per year, the Dry Arch, only 50 km. away, receives only 1,000 mm / year, making it the driest region in the country. Additionally, this area was the first to be occupied by human settlements, which could be associated with the extent of natural resources deterioration seen today[18].

25. The modeling for climate change scenarios for Panama revealed changes in this area in relation to temperature and rainfall patterns. Such changes include a warmer environment of 2°C to 3 °C over current temperatures, while changes in rainfall could be in the range of +/- 10% depending on the area. Nevertheless, relative changes in Panama's climate have already taken place, as the dry seasons have been reflecting a trend of increasingly warmer events (1°C over historical values) and in the past 50 years the inter-annual rainfall decreased 50 to 100 mm per month, which is equivalent to a variation of -6% to -10% in volume of precipitation in the rainy season[19].

26. Regarding vulnerability to climate change, the study of the Santa Maria river basin is the main source of updated information on future vulnerability of water resources, and specifically, in relation to agriculture[20]. This watershed was prioritized due to its importance for the region and the country, as well as for the precarious condition of the water resources within it.

The study of the Santa Maria River

The basin of the Santa Maria River covers the provinces of Veraguas and Herrera, and is composed of rural environments with great potential for projects under the Clean Development Mechanism (CDM) of the Kyoto Protocol endorsed by Panama. At the same time, it is mostly under usage by subsistence and seasonal farming. In 2003, the watershed was the national case for the regional project "Fostering Climate Change Adaptation in Central America, Mexico and Cuba, Stage II", sponsored by UNDP and GEF, due to its degraded conditions as well as its importance for the local population in relation to agriculture activities. Water scarcity related to climatic conditions affects irrigation and availability for consumption by livestock, crops and pastures causing yields' reductions during latest years. Similar impacts are affecting water availability for human consumption in the upper watershed areas. Drought set features such as soil erosion and diminishing of fertility and yields as threats for farmers and local population. Desertification may seriously affect agriculture and water for human consumption in the near future, while, rainfall episodes of 50 mm /day or more usually turned into extreme events and damages in this area. However, climate change studies suggest a very likely reduction in the frequency of such episodes. (*ANAM, 2004. Estudio hidrometeorológico de la Cuenca del río Santa María*).

[17] Idem.
[18] Ibídem
[19] ANAM. 2011. Panamá. Segunda Comunicación Nacional ante la Convención Marco de las Naciones Unidas sobre Cambio Climático. Autoridad Nacional del Ambiente. Panamá, Panamá
[20] Ibídem

27. The Diagnostic of Dry and Degraded Lands of Panama – baseline study of the National Action Plan for Drought and Desertification – identified four critical areas exposed to drought and soil degradation: Cerro Punta, *Comarca Ngöbe Bugle*, Dry Arch and the Sabana Central Veragüense. They represent a territory of 20,787 km2 with 516,434 inhabitants - according to the Population Census of 2000[21]. Despite reforestation policies promoted by ANAM, there is evidence that forests within the Dry Arch Area have not recovered at all from decades of intensive exploitation by livestock and agriculture practices still profusely in use. Nevertheless, during the last few years, wetlands and low lands from Coclé, Los Santos and Herrera have showed signs of regeneration.

28. Environmental, and particularly basin, degradation is quite significant in all the Dry Arch area, as a result of the on-going desertification process. Furthermore, the Dry Arch is the only region in the country facing a water deficit situation, since the rest of the regions are characterized by good quality surface water sources. The Dry Arch has undergone frequent periods of droughts for as long as seven months, leading to intense competition for water resources. The basins most affected by this critical situation are La Villa, Guarare, Grande and Chico. Although groundwater is not as threatened as surface water sources, some deficits due to salinity and hardness were registered in the Dry Arch. The annual amount of water for exploitation was estimated in 3.31 km^3[22]

29. Precipitation average in the Dry Arch is 1,000 mm/year. Combined with inadequate agricultural practices, low precipitation has undermined the local resources, diminishing productive capacity of soils and causing high sedimentation rates of rivers and creeks, leading to a current scenario of land degradation and soil erosive processes which tend to get worse in time[23]. The cyclic situation of drought in the watershed of Santa Maria River has become frequent for the entire Dry Arch area. For the period of 1997-1998 during the most severe El Niño event in the last decades, the temperature reached as much as 2°C over the normal seasonal temperatures. The highest temperature ever for the town of Santiago, in the province of Veraguas was as high as 39.4°C and it got registered under El Niño influence, which caused losses over 70% of the region. The agriculture sector in the Dry Arch only, lost over US$ 16.4 million; irrigation, livestock and the availability of drinking water were also significantly affected due to scarcity[24].

30. Groundwater is exposed to uncontrolled and intensive extraction, and its actual availability and the rate of its extraction remains uncertain. Over two million hectares in the central provinces of the country - 27% of the whole territory – are already classified as degraded[25]. The water resources sector is not only affected by deficits due to droughts, but also to excessive runoff, floods and sedimentation of rivers during the rainy season, which have damaged power and drinking water infrastructure and irrigation systems, diminishing regional economic growth and human development due to its adverse effects on agriculture and major economic activities for years[26].

31. The Pacific slope has the richest water resources in the country, due to the largest hydrographic basins: the Santa Maria, the Bayano Chepo and Tuira-Chucunaque. The combined area of these basins represents 70% of the country[27]. However, the Azuero Peninsula and the Cocle Plains, as

[21] Ibidem.
[22] ANAM, 2012.
[23] ANAM, 2012
[24] Idem
[25] ANAM, 2009.
[26] ANAM, 2012
[27] MINSA, 2007. Estudio Técnico – Financiero, Socioeconómico y de Identificación de proyectos para PASAP (Proyecto de Agua y Saneamiento en Áreas Pobres). Marco de Evaluación Ambiental. Ministerio de Salud. Dirección Nacional de Políticas del Sector Salud. Unidad Coordinadora de Proyecto de Salud Rural. República de Panamá. Panamá.

part of the Dry Arch, are the poorest ones regarding such resources. There are many causes of degradation of the surface water sources in Panama: absence of an integrated watershed approach as a planning unit for sustainable development; poor protection and inadequate use and conservation of water resources; lack of planning and management from an integrated perspective of programs for the optimal use of those resources; poor development of hydraulic infrastructure required to store and distribute water more effectively in critical areas such as the Dry Arch[28].

32. Agriculture represented in Panama 4,6% of GNP in 2003 and 9% of employment positions (179.182 workers), while the value of agriculture production has grown 2,2% of average annual rate since the 1990s; 60% of such value comes from silviculture and crops production; 40% from poultry and livestock. Although rice, corn and banana and other traditional crops have been reducing their contribution to GNP, the exportation of non-traditional produce such as vegetables, fruits and ornamentals (cantaloupe, water melon, pineapple, zucchini, gourmet coffee, and orchids) is currently enlarging the area for production and their significance to the NGP[29].

33. The Dry Arch is known as an agriculture region where most of those activities are quite important[30],[31]:

- *Corn*. Azuero (Herrera, Los Santos) is the most important region in the country regarding this production (70% of total national yield).
- *Rice*. Coclé and Herrera have the most extensive area under flooded rice (40% of total area). The Dry Arch provides 35% of the national production of this crop.
- *Industrial tomato*. In Los Santos and Herrera are the principal (300 ha; 1500 qq/ha in yields, due to irrigation and agronomic techniques)
- *Onion*. Coclé, Herrera and Los Santos
- Cucurbitáceas. In Herrera, Los Santos, Veraguas, Chiriquí y Coclé this activity has turno into greater employer (on the ground and in packinghouses; nearly 750.000 job positions in 2007-2008; 400 farmers involved). This produce include:
    - Cantaloupe (2.062,35 ha; 475.879,11 qq.); Los Santos and Cocle are the most succesful ones regarding the amount of yields, (249.803,16 qq and 105.843,54 qq., respectively)
    - Watermelon. Although Veraguas and Chiriquí are the most important ones in this kind of produce, in the Dry Arch (Coclé, Herrera, Los Santos) contributed with 892.126 qq.). This is a high technology agriculture activity based mostly on drip technology.

- Regarding poultry, the Dry Arch represents over 65% of total national production, while under livestock production it has 667.222,6 ha and 490.252 cattle[32].

In general, Herrera and Los Santos gather over 50% of total surface under agriculture production in the country. The latter itself is providing 50,9% of total cantaloupe production[33]. The same provinces gather as well 45% of total coffee entrepreneurships[34].

[28] Idem
[29] Viceministerio de Comercio Exterior, 2006. Actualización de la oferta exportable. Ministerio de Comercio Exterior. Gobierno Nacional. Panamá
[30] Information of the year of production from 2007-2008
[31] ANAM, 2009. Atlas de las tierras secas y degradadas de Panamá. Autoridad Nacional del Ambiente, Gobierno de Panamá.
[32] Data of Agriculture Census, year 2000, as referred in , in ANAM, 2009.
[33] Ibíd.
[34] Viceministerio de Comercio Exterior, 2006.

34. Although very important for agriculture, this region is exposed to climate variability and the potential adverse effects of climate change trends, which are increasingly affecting and threatening the livelihoods of the farming sector, as well as the potable water, sanitation and food security conditions of the communities living in this area. Amongst them, food insecurity and chronic malnutrition in Veraguas and Cocle are respectively third and fourth in the country, with values of 29,6% and 23,4%, each, only after some of the native communities and Bocas del Toro. These scenarios are associated with extreme poverty and exclusion in every case and are prone to be worse under expected conditions of climate change and exacerbation of events of climate variability[35].

35. As such, drought events related to El Niño and other phenomena have historically affected the territory of Panama and its agriculture. The Dry Arch is one of the four most critical areas exposed to drought and soil degradation in the country, exacerbated by a traditional practice of indiscriminate logging and other inadequate agriculture techniques. Such context is affecting livelihoods and diminishes production capacities in the region, including local dairy and subsistence farmers.

36. In 1982-1983 ENSO seriously affected the agriculture sector with losses of US$14 million in livestock and US$6 million in crops[36]. In 1997 -1998, it stroke again and the losses reached as much as US$40 million. Only dairy production lost 7.4 million of lt., equivalent to US$ 1,847, 263. Due to ENSO, the GNP for the agriculture sector suffered a contraction of 3.7 %. The drought event of 2001 caused the death yield reduction in several crops and reduction of area under production due to the uncertainty of the farmers regarding the rainfall patterns for that season. Dairy production was affected again, as it reduced the volume in 10.4 million of lt. and the loss of 2,500 cattle. Again, seasonal crops in Coclé and Herrera were affected by drought during a critical period of the production (July, August, September and October), when the most important volume of rainfall is expected for harvesting. As defines by MIDA, the most severe effects of drought and ENSO in Panama take place in Herrera, Los Santos, Coclé, Veraguas, Western Panama and the Easter Area[37].

37. Regarding actions on irrigation to counteract drought effects in this region, some initiatives were establish in the past. Among them, Azuero and Cocle producers promoted in 1992 and 1993 the use of irrigation, as a result of the effects of drought in that time associated to an El Niño event. However, around 7.000 ha ceased to be irrigated between 1990 and 1995, most of which were part of public irrigation systems. This was a result of the economic downturn at the beginning of the decade and the subsequent deterioration and abandonment of public farms. Since 1995, renewed interest in modernizing agriculture production and increasing productivity brought interest to improve the conditions for crops and livestock. The main irrigation area is located in the provinces of Chiriqui, Veraguas, Cocle, Herrera and Los Santos.

38. In relation to other activities important for the economy of the Dry Arch that could be affected by changes in climate and climate variability, this region is the third most important touristic zone of Panama. It goes all the way by the coast belt of Herrera and Los Santos. The limits of this zone are the coast over the Bahia of Parita and the National Road between the provinces of the Azuero Peninsula and from the town of Santa Maria, in the province of Herrera to the Southern extreme of the Province of Los Santos. Water scarcity for hotel premises and touristic activities could threat

[35] FAO, 2006
[36] Values of 1982
[37] MIDA, 2009. Plan Estratégico para Mitigar los efectos del fenómeno de El Niño en el sector agropecuario (2009-2010). Ministerio de Desarrollo Agropecuario. Gobierno de Panamá.

future developments and reduce options of diversification in the area, while traditional agriculture sector may keep contracting in this region.

Climate vulnerability in the Panama Canal Watershed

39. The Panama Canal Watershed (PCW), with its storage area of 3,453.19 km2, drains 5379 million cubic meters of water per year, supplying enough water for the Panama Canal´s functioning and for potable water for the cities of Panama and Colon, which constitutes approximately half of Panama´s total population. The Panama Canal Watershed has shown vulnerability to climate change phenomena at various times, , two of them from causes that could be considered as extreme events that occurred in 1997-1998, and in December 2010. The effects of these events, drought in first place and excess of rain in the second, affected the whole country with losses of, and damage on human lives, infrastructure, health and food security, economy and a diminished supply of drinking water production for Panama and Colon Provinces. In both cases, the Panama Canal operation stopped.

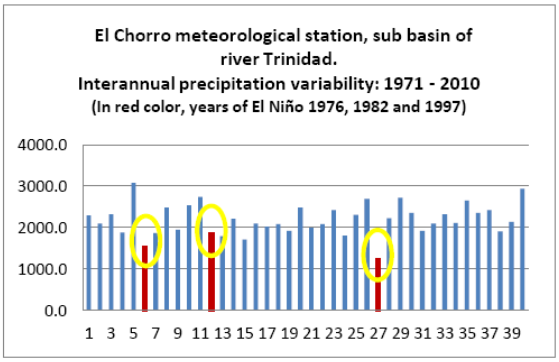
40. In September 2011, the Water Center for the Humid Tropic of Latin American and the Caribbean (CATHALAC) released a study focused on the evaluation of the actual vulnerability of human and natural system in the Panama Canal Watershed for the period 1970-2010. This study, commissioned by the Panama Canal Authority, provides a better understanding of the spatial and temporal distribution of rainfall in different scales (monthly, stationery and annually), characterizing the foremost climate threats (drought and flooding). This study included vulnerability assessments in 50 sub basin and townships with the purpose of identifying the most vulnerable communities to climate change and variability in the watershed.

41. According to the aforementioned study, and based on NOAA´s classification, thirteen (13) El Niño and 12 La Niña events affected the Panama Canal Watershed between 1971 and 2010. These events are generally associated with water stress or a very pronounced dry season. The annual precipitation maximum produced by these events varies depending on the location of every one of the tributary sub basins.

42. During the "rainy season" - from May to December - the seasonal precipitation decreases in the direction of east to west, and north to south in the Panama Canal Watershed, which accumulates 3000 mm and 3900 mm in the eastern part and between 2600 and 3200 mm in the northeastern area. The *Pacific Transisthmic corridor,* bounded by the sub basins of Chilibre and Chilibrillo, show precipitation values from 2100 to 2300 mm. The southern part of the Watershed proves to be the driest, with of 1700-1900 mm in Miraflores Lake sub basin. The entire southern part of the Alhajuela Gatun and the West Panama region are bounded by isohyets of rainfall between 1900 and 2000.

43. During the "dry season" - from January to April -the spatial distribution of precipitation maintains similar spatial patterns as the total annual precipitation reports, where the east part of the watershed receives the most rains, , with an average value ranging from 300 to 500 mm. The southern and western sides show similar stationary rain accumulation ranging from 50 to 100 mm, and reaching from the sub basin of Chilibre, Chilibrillo passing through Miraflores Lake and the entire region of west Panama, to the Quebrada Grande sub basin. Although the El Niño influence is associated with the reduction of rainfall (monthly and annual), in some cases the rainy season may as well surpass the historical record of rainfall, which happened in 1976, 1982 and 1997. This knowledge can be useful for the management of the reservoir during future events, especially in the context of climate change.

Fig. 9, 10. Impact of El Niño (1976, 1982, 1997) on monthly and annual precipitation, sub basin of river Trinidaa (western section of the Panama Canal watershed)



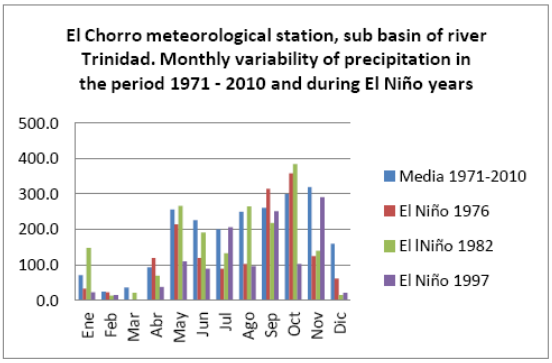
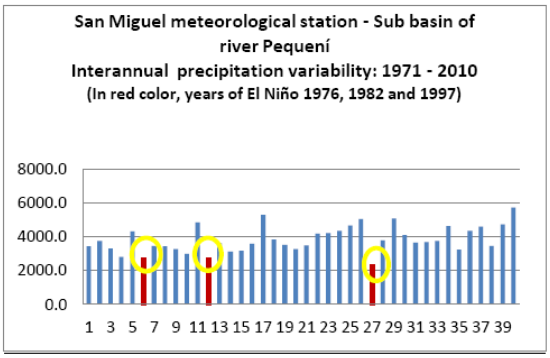
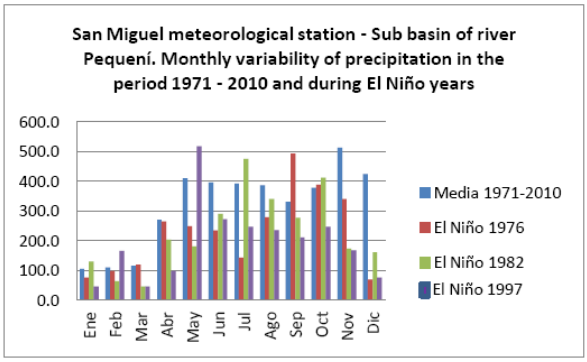


Fig. 11, 12. Impact of El Niño (1976, 1982, 1997) on annual and monthly precipitation, river Pequení (eastern section of the Panama Canal watershed)





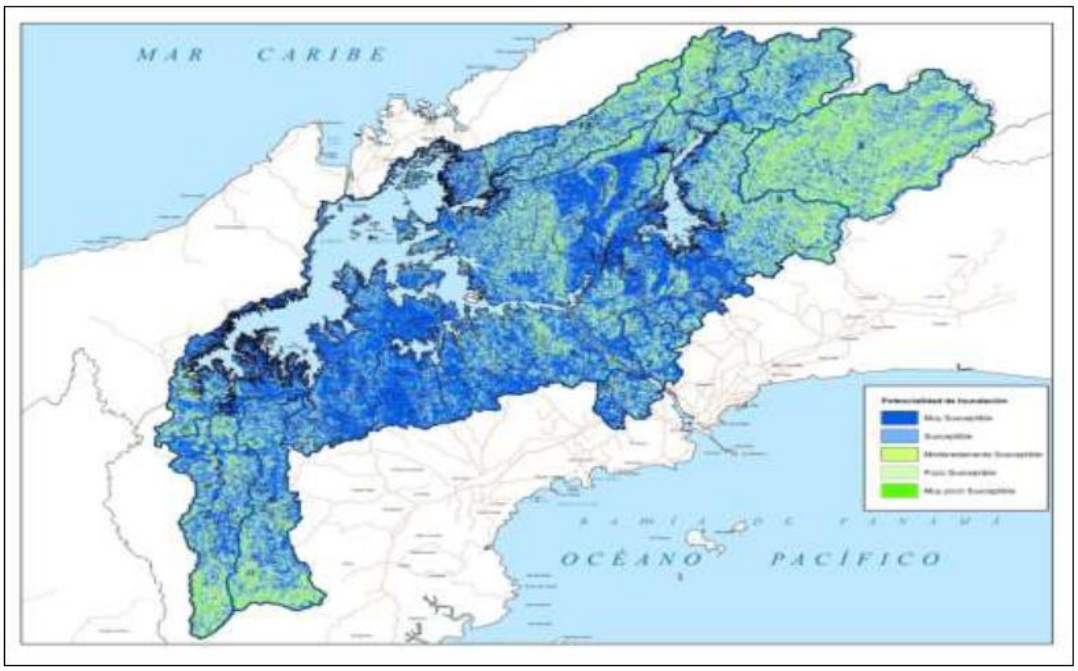
Source: CATHALAC, 2011.

44. These charts compare the data the sub basin of river Trinidad, over the western side of the Panama Canal to those of the basin of river Piquene, on its eastern side. They show a reduction on precipitation during El Niño 1976, 1982 and 1997 in both areas, but the first one on greater degree (nearly 1000 mm less in the pluviosity registered, remarkably significant in 1997 as the worse case), as it is located closer to the Dry Arch area. Hence, annual and monthly rain measurements decreased in the areas surrounding both meteorological stations[38].

45. The analysis conducted by CATHALAC in 2011 included the generation of a baseline for current socio-economic vulnerability. This was used for the evaluation of flood and drought vulnerability and so, they allow the identification of the most vulnerable sub basins within the Panama Canal watershed. While places more prone to flood are located preferably by North, West and South of lake Madden and South and Southwestern of Lake Gatun, the ones more vulnerable to droughts are those closer to the Dry Arch and over the Pacific region of the Panama Canal (Fig.13, 14).

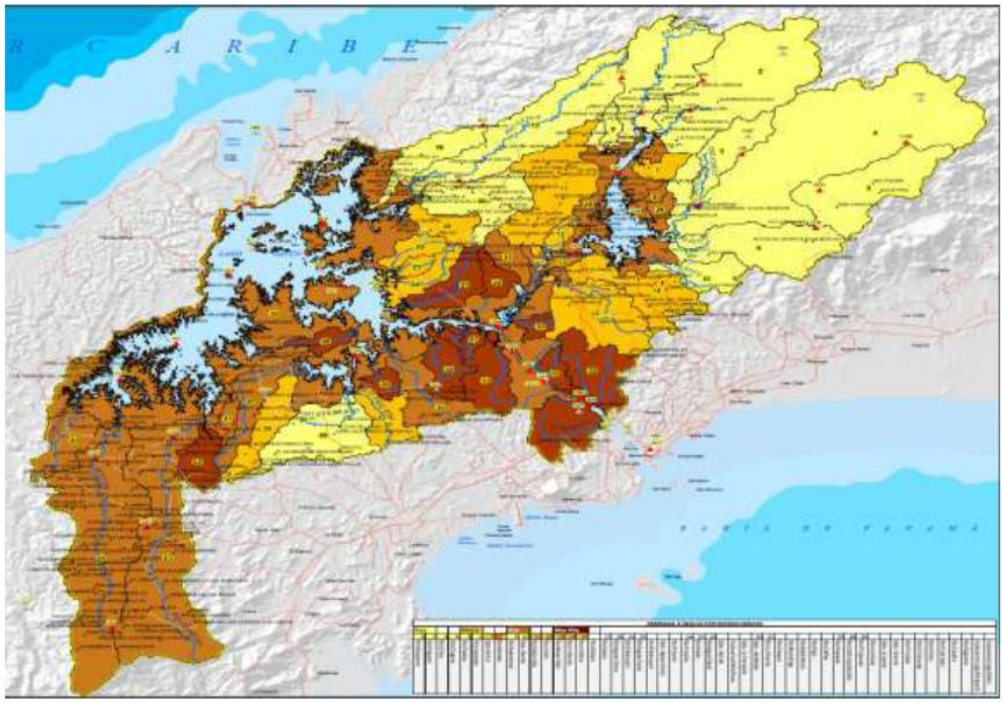
[38] CATHALAC, 2011

Fig. 13. Vulnerability to flooding in the Panama Canal watershed, based on the period 1971-2010



Source: CATHALAC, 2011

Fig. 14. Drought hazard in the Panama Canal Watershed for the period of 1971-2010



Source: CATHALAC, 2011

46. The sub basins selected as the most vulnerable to floods and drought, in terms of socioeconomic and hazard levels, are Chilibre, Chilibrillo and Trinidad. The Chilibre and Chilibrillo sub basins are part of the Pacific Sector of the Transitsmic Corridor, which flows to the Chagres River, and are located in the most populated area of the Panama Canal Watershed, having each of them 30,630 and 38,221 inhabitants, respectively. This region has significant social and environmental problems, such as poor access to drinking water, garbage collection system and electricity services, due to rapid and unplanned urban development patterns. As a consequence, it has the highest demand of water within the basin, although it has poor quality[39].

47. Data related to current socioeconomic vulnerability in the watershed is presented in fig.15. Based on the results obtained from the estimated indicators of current socio-economic vulnerability and vulnerability to flooding and drought events, the most vulnerable sub basins are Chilibre, Chilibrillo; Miraflores, Alhajuela and Lake Gatun. The basins of Agua Sucia and Limon were classified as under ¨very high¨ and ¨high¨ socioeconomic and biophysics vulnerability to drought and flooding. This study also identified a second group of 13 critical sub basins within the area of the Panama Canal watershed, featured by the following conditions: (a) 77% of them under moderate socioeconomic vulnerability; (b) 69% of them of moderate vulnerability to flooding (c) 62%, under high vulnerability to drought. Among this group, the most vulnerable ones are those adjacent to the rivers Gatun, Obispo, Trinidad, Gatuncillo and Aguas Claras[40].

Fig. 15. Current socioeconomic vulnerability and vulnerability to drought and floods in the Panama Canal Watershed, 1971 - 2010

Nr.	Sub basin	Current socioeconomic vulnerability	Current vulnerability to floods	Current vulnerability to droughts
1	River Chilibre	Very high	High	Very high
2	River Chilibrillo	Very high	High	High
3	Lake Miraflores	High	High	Very high
4	Lake Gatún	High	High	Very high
5	Lake Alajuela	High	High	High
6	River Agua Sucia	High	High	High
7	River Limón	High	High	High
8	River Gatún	Middle	Very high	Very high
9	River Obispo	High	Middle	Very high
10	River Trinidad	High	Middle	High
11	River Gatuncillo	High	Middle	High

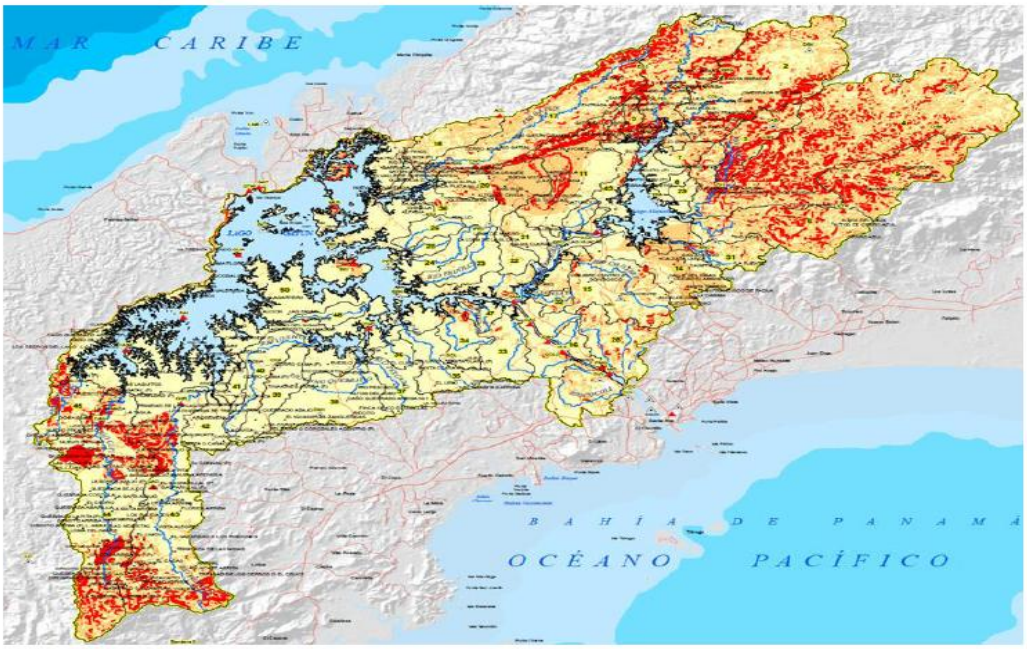
Source: CATHALAC, 2011

48. This table presents de most critical sub basins within the Panama Canal watershed. They represent a sub subset of 27 of the total basins located in that area, according to their conditions regarding biophysical and socioeconomic vulnerability regarding flood and drought events.

[39] Ibídem
[40] CATHALAC, 2011

49. The areas located by the Western and Eastern extremes of the Panama Canal watershed are subject to the most significant exposure to landslides within the basin, as appeared in fig. 16, as was establish through a study based on factors such as *slope, soil humidity and lithological susceptibility of the ground.*

Fig.16. Susceptibility to landslides in the Panama Canal Watershed



Source: CATHALAC, 2011

50. The Chilibre sub basin has a total drainage area of 80.8 km2, which represents a 2.37% of the surface of the Panama Canal Watershed, within the townships of Las Cumbres, Ancón and Chilibre, all located in the Panama District. The Chilibrillo River is the main tributary of the Chilibre River. This sub basin covers a 60.4km2 which are drained by the Chilibrillo River. According to CATHALAC´s study, the sub basins of the rivers Chilibre and Chilibrillo have high levels of vulnerability to drought and floods. The hydric overload in the soils, produced by the precipitation and the surging of the rivers, causes the absence of vegetation in the margins of the rivers, and can worsen flooding, which affects agricultural production, industry and environment.

51. The sub basin of the Trinidad River is part of the eastern zone of the Panama Canal Watershed and the population living here attaches great socio-economic importance to the preservation in quantity and quality of water resources. This sub basin has a population of 5,181 inhabitants and it is 100% rural, under basic housing conditions. The main economic activity is agriculture and the monthly income is up to US$80.71 for the high trench of the Watershed, and US$79.25 for the middle and low trench (Socio-Economic Census, 2000). The livestock, in order of importance, is based on cattle, chicken and pigs. The agriculture is based on a model of substance farming with extensive practices of low technology. According to CATHALAC´s study, the sub basin of Trinidad presents an increasing high vulnerability level to drought and floods, in part due to the practice of burning and timber of the forest nearby, as well as fragmented vegetable cover caused by loss of soil absorption of water and storage capability[41].

[41] CATHALAC, 2011

V. Summary of main "adaptation issues" to be addressed through this project

52. Although Panama is relatively less vulnerable to hurricanes and other catastrophic events than other countries in the Central American region, it is frequently affected hydro-meteorological hazards, including floods, droughts and landslides. With the exacerbating effect of climate change, the frequency and intensity of extreme weather events –including the *El Niño* Southern Oscillation (ENSO)- are expected to rise. The hazard scenario overlaps with an increasing vulnerability associated to a higher degree of physical exposure of population and goods, fed by a rapid demographic growth and unplanned urban expansion, and combined with environmental degradation processes. The resulting risk configuration has been manifested in a series of disasters with significant losses in the latest decade.

53. According to CEPAL´s study *The Economics of Climate Change in Central America (2010),* expected changes in temperature and intensification of storms for Panama, will bring about a series of physical and economics impacts. The study also highlights the economic vulnerability of key sectors such as agriculture and tourism, as well as the vulnerability of the Panama Canal Watershed and its associated economic activity.

54. In terms of climatic variability, hydrological studies show that during ENSO events there is a decrease in the levels of the artificial lakes that feed the Panama Canal system. During the 1982-83 and 1997–98 ENSO events the Panama Canal watershed experienced severe droughts which resulted in the imposition of ship draft restrictions and a reduction in the number of vessels allowed through the Canal. In the same fashion, land areas under soil degradation processes, such as the Dry Arch, in the Azuero Peninsula, are increasingly affected by droughts, threatening the livelihoods of local farmer population, and affecting important sectors of the agricultural sector, such as the dairy industry, heavily concentrated in this area of the country.

55. On the other hand, cold fronts at the end of the rainy seasons that remained stationed over the Panamanian territory have caused unusual intense and prolonged rains, triggering floods and landslides of considerable impact in the country. Just in the last two years Panama faced two disastrous floods events that led to the declaration of national emergency. The first event, in December 2010, caused damages estimated in US$150 million, and left a high percentage of the Panama´s capital without drinkable water for several weeks. The latest emergency, in November 2012, affecting urban areas in the Panama Canal Watershed, and triggered the early implementation of the 2012 established new Sovereign Fund (*Fondo de Ahorro de Panama*), in order to be able to access funds to attend the rehabilitation and reconstruction works.

56. Despite the sustained progress of Panama on advancing the political and programmatic frameworks for Climate Change in the last five years, the trend of recent disasters associated to hydro-meteorological hazards has revealed an increasing vulnerability profile to climate variability that calls for a prompt implementation of climate resilient measures in the most vulnerable geographical areas as well as for an overall enhancement of the climate change knowledge and institutional strengthening to move forward the policy frameworks for adaptation to climate change.

57. This concept project being submitted to the Adaptation Fund addresses both needs, by tackling the current climate vulnerability in two critical geographical areas of the country, such as the Dry Arch and vulnerable sub basins of the Panama Canal Watershed, which provide representative climate vulnerability scenarios with potential for replication in other areas of the country. At the same time, these geographical specific interventions are accompanied by two lines of actions aimed at improving the climate information baseline and monitoring tools, as wells as enhancing the

knowledge management capacities, fostering an integral disaster risk reduction and adaptation to climate change approach the targeted areas.

PROJECT / PROGRAMME OBJECTIVES:

The overall goal of the proposed project is to: ***"reduce vulnerability to the adverse effects of climate change and variability in the most vulnerable communities in the Dry Arch and Panama Canal Watershed, in the Central Pacific Region of Panama."***

In order to achieve this goal, the project includes four components with the following objectives:

Component 1: 1. Strengthening the network of hydro-meteorological stations and climate information products for enhanced climate information in target areas

Objective: An overall improved baseline of climate information and strengthened national and local capacity for decision making in climate adaptation in targeted vulnerable farming communities of the Dry Arch

Component 2: Enhancing adaptive capacity to climate change and climate variability in farming communities in the Dry Arch

Objective: enhanced agricultural and water management climate resilient practices in selected vulnerable farming communities in the Dry Arch.

Component 3: Reducing vulnerability to climate change and variability in three vulnerable sub basins of the Panama Canal Watershed

Objective: reduced vulnerability to flooding, erosion, landslides and droughts associated with climate variability and climate change in communities located in the Chilibre, Chilibrillo and the Trinidad River sub basin, in the Panama Canal Watershed.

Component 4: Stakeholder processes, knowledge management enhancement, and climate risk awareness-rising across key institutional drivers and communities targeted in this proposal

Objective: Key DRR and CCA national stakeholders, and local stakeholders and decision makers in project targeted communities, more visible, networked, informed, equipped and enabled, to affect climate change adaptation and climate smart development and planning, and disseminate good practices for replicability elsewhere

PROJECT / PROGRAMME COMPONENTS AND FINANCING:

Fill in the table presenting the relationships among project/programme components, activities, expected concrete outputs, and the corresponding budgets. If necessary, please refer to the attached instructions for a detailed description of each term.

PROJECT/PROGRAMME COMPONENTS	EXPECTED CONCRETE OUTPUTS	EXPECTED OUTCOMES	AMOUNT (US$)
1. Strengthening the network of hydro-meteorological stations and climate information for enhanced climate information products in target areas	1.1. Network of hydro-meteorological stations in the Dry Arch is strengthened through the modernization of 67 stations and installation of 21 new stations (US$ 1,220,000)	An improved baseline of climate information strengthening national and local capacity and enhancing decision making for climate adaptation in target areas	1,400,000
	1.2. A fully operative drought monitoring system based on climate indicators, with required software and quality control of meteorological and climate data, developed. (US$ 100,000)		
	1.3. *Climate change scenarios of 25x25 km or greater scale resolution focused on vulnerability of main economic activities (agriculture) specifically developed for the Dry Arch area* (US$ 80,000)		
2. Enhancing adaptive capacity to climate change and climate variability in farming communities in the Dry Arch	2.1. Sustainable silvo-pastoral production and agro-ecological farming practices are implemented in vulnerable farms in the Dry Arch (1,800 rural *families targeted*) (US$ 127,000)	Strengthened farmers capacities for implementation of adaptation measures to increase their resilience to the impacts of climate change and improve food security	1,849,000
	2.2. Solar water pumps and water harvesting systems established in at least 80 vulnerable farms and 50 rural schools in the Dry Arch US$536,500		
	2.4. Optimization of four irrigation systems benefiting 150 farms in Coclé Province is achieved. (US$ 236,000)		

	2.5. Participatory Climate Change Adaptation and Disaster Risk Reduction plans produced by five priority Watershed Committees in the Dry Arch. (Santa Maria, La Villa, Parita, Antón and Grande) (US$ 250,000)		
	2.6. Forty (40) Farm Schools, 20 pilot model farms and an institutional supporting network established in the Dry Arch (US$ 500,000)		
3. Reducing vulnerability to climate change and variability in three vulnerable sub basins of the Panama Canal Watershed	3.1. At least 400 hectares with agro and silvo-pastoral practices for reduced flood vulnerability established in Chilibre, Chilibro, and Trinidad River sub basin (US$700,000)	An improved soil absorption capability in the basin reducing the vulnerability to floods in target communities in the Panama Canal Watershed. An enhanced water management and storage is implemented strengthening local capacities for adaptation to increasing drought and water stress conditions in target communities of Panama Canal Watershed.	1,250,000
	3.2. At least 50 Farm Management Plans with an integral climate resilient approach established in the Trinidad river sub basin. (US$200,000)		
	3.3. Two water harvesting programs in Chilibre, Chilibrillo and Trinidad sub basins (US$200,000)		
	3.4. Coordination and consultation mechanisms in place among public institutions and stakeholders to address climate change effects in Chilibre, Chilibrillo and Trinidad sub basins (US$ 150,000)		
4. Stakeholder processes, knowledge management enhancement, and climate risk awareness-rising across key institutional drivers and communities targeted in this proposal	4.1. Participatory Stakeholder Processes and Knowledge Management Guidelines (US$ 180,000)	Strengthened national, regional, and local institutions and organizations implementing planned adaptation measures to climate change and replicating activities and lessons learned	590,000
	4.2 Project Network Established (US$ 50,000)		
	4.3. Project Produced Climate Change Adaptation Training Materials (US$ 200,000)		
	4.4 Communication and Public Education Campaign (US$ 160,000)		

5. Project/Programme Execution cost	305,340
6. Total Project/Programme Cost	5,394,340
7. Project/programme Cycle Management Fee charged by the Implementing Entity (if applicable) 7%	377,604
8. Total Financing requested	6,077,284

PROJECTED CALENDAR:

Indicate the dates of the following milestones for the proposed project/programme

MILESTONES	EXPECTED DATES
Start of Project/Programme Implementation	February 2014
Mid-term Review (if planned)	February 2016
Project/Programme Closing	February 2018
Terminal Evaluation	March 2018

PART II: PROJECT / PROGRAMME JUSTIFICATION

A. Describe the project / programme components, particularly focusing on the concrete adaptation activities of the project, and how these activities contribute to climate resilience. For the case of a programme, show how the combination of individual projects will contribute to the overall increase in resilience.

The overall objective of the proposed project is to build capacity for improved climate change adaptation and disaster risk reduction with a focus in two vulnerable and prioritized areas of the country. The project comprises four components addressing a range of challenges and needs to foster climate adaptation in the country, from basic data information and capacity building needs, to the implementation of concrete climate resilient practices. Two components are tackling structural climate information gaps and strengthening institutional and community capacities that are hindering the progress in climate change adaptation efforts, across the target intervention areas (components 1 and 4). The other two components (2 and 3) are designed to implement a set of climate resilient practices in the two prioritized target areas. The implementation of the four components will substantially contribute to increase the knowledge on the application of local climate resilient practices as well as inform climate adaptation initiatives in other vulnerable areas of the country.

COMPONENT 1- Strengthening the network of hydro-meteorological stations and climate information products for enhanced climate information in the target areas.

Component 1 focuses on strengthening the existing hydro-meteorological network and enhancing key climatic information products to support planning and inform adaptive measures at local level and regional level, for mitigating the impacts of climate change and climate variability induced risks in the critical area of the Dry Arch. Given the technical nature of the actions proposed under this project component, Hydro-meteorological Direction of the Electrical Transmission Company, ETESA, in close coordination with ANAM, will lead their implementation. ETESA is the national entity responsible for establishing and operating national-level meteorological and hydrological infrastructure to provide information, predict weather patterns, issue advisories, and provide climate-related services in the country.

The overall objective of this component is to improve the gathering, monitoring and processing and dissemination of climatic data, improving the climate information baseline to support informed adaptive and risk reduction measures for climate risks affecting vulnerable communities in the targeted Dry Arch of Panama. This component encompasses three concrete outputs:

Output 1.1.- Network of hydro-meteorological stations in the Dry Arch is strengthened through the modernization of 67 stations and installation of 21 new stations.

Panama does not have a National Hydro-meteorological Service. Instead, the National Electrical Transmission Company, ETESA, through its Hydro-meteorological Division, is the entity in charge of operating, maintaining, and expanding the hydro-meteorological network. One of the challenges for climate monitoring and research in the country is the fact that the spatial distribution of the network responds primary to hydro-electrical energy needs rather than climate information needs for

multiple users, including ANAM. In addition, part of the network consists of manual stations with needs to be modernized to address the current needs from multiple users. In response to this need, ETESA has designed an expansion and modernization plan of the network, which it is been gradually, implemented by contributions from other public institutions such as the Ministry of Agricultural Development (MIDA), and more recently, ANAM[42]. Still the density of stations is below the recommended ratio by the World Meteorological Organization (WMO), particularly in some critical areas, such as the Dry Arch. In addition, most of the stations are 30 years old and manual.

The new automated stations will provide data at a significantly greater frequency, recording physical parameters (i.e. rainfall, wind, temperature, etc.) every minute, in all weather conditions, day and night all year around. The technology will also provide accurate and useful data on extremes in climate in the Dry Arch region. The improved hydro-meteorological network will allow climatic estimates and scenarios to be made available by a variety of communications channels, tailoring information according to target audiences. Furthermore, this data will be available to various related regional and international institutions and organizations.

The envisaged support from the project will allow the modernization of all the stations that are being operated in the Dry Arch, and the expansion of the network with the installation of new stations according to research and sectoral needs. The type and final sites for the new stations will be decided by a combined team from ETESA and ANAM. The data collected will be stored as part of ETESA´s hydro-climatological system and shared with ANAM as part of its environmental information system, and hence can be readily integrated into existing and readily used infrastructure and processes, including the early warning system.

All data will be stored as part of the National Hydro-meteorological Network administered by ETESA. Additionally, ETESA will ensure that the stations are operational through the life of the project and beyond. The stations will provide information regarding river water levels and flows, water levels in lagoons and wetlands, atmospheric temperature, rainfall, and relative humidity, among other climatological and hydrological variables. ETESA will assume the responsibility over the maintenance of the stations after project completion.

Activities

1. Complete modernization of forty five (45) conventional stations with new automated equipment. The existing conventional stations (mechanical) hydro-meteorological stations will be replaced with automated stations: two (2) automated hydrological stations, two (2) automated climatological stations, and five (5) automated precipitation stations with satellite transmission.

2. Implementation of real-time communication in twenty two (22) existing automated stations. ETESA technicians will calibrate all of the equipment/sensors onsite and will run tests to ensure that all the equipment is working (capturing and transmitting data) properly.

[42] Describe the MoU

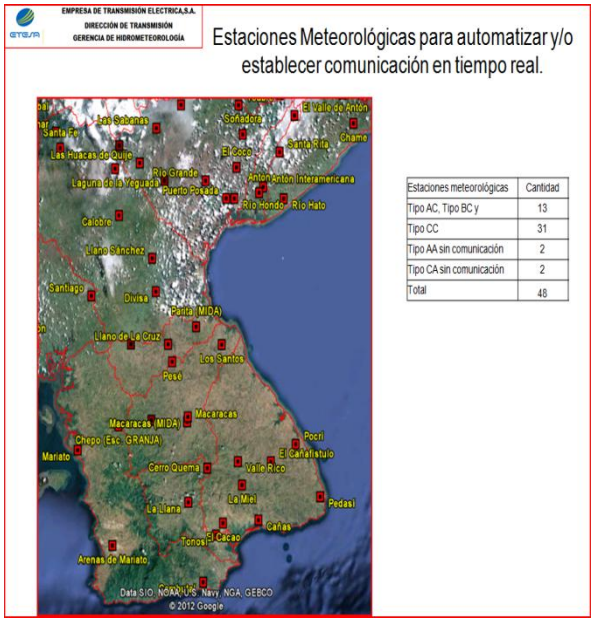
3. Installation of twenty one (21) new stations in new sites. These will be three (3) meteorological stations type AA, nine (9) meteorological stations type CA and nine (9) hydrological automated stations. The final sites for installation of the stations will be selected by ANAM and ETESA. ETESA will purchase all of the required equipment (hardware and software) and will be responsible for all import procedures as the needed equipment must be purchased overseas.

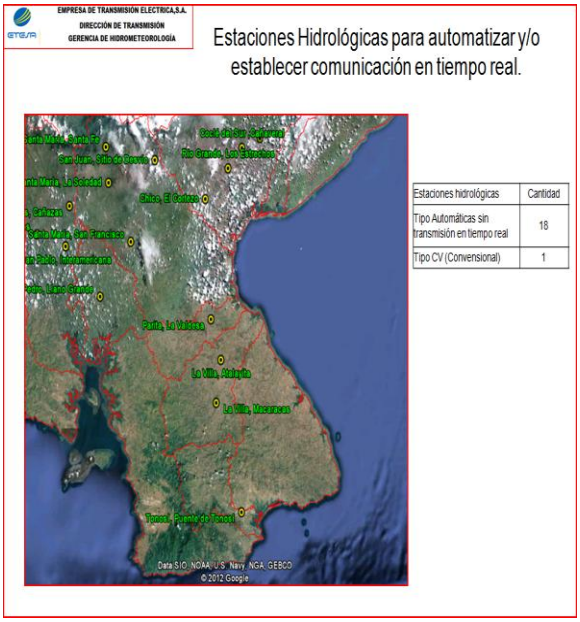
DESCRIPCIÓN	2014	2015	2016	2017	Total	New sites
Meteorological Stations Type AA	4	4	4	4	16	3
Meteorological Stations Type CA	10	10	10	10	40	9
Meteorological Stations Type AA(only transmissions and accessories)	2					
Meteorological Stations Type CA (only transmissions and accessories))	2					
Hydrological: (only transmissions and accessories: 2014 y 2015. Complete stations : 2016 y 2017)	10	8	5	5	10	9
Total of new stations					**66**	
From the total of new stations (66), 21 will be located in new sites:						21

4. Acquisition of replacement parts for years 2016-2017

5. Development of a system for data compilation, quality control and information accessibility, including climate services based on information generated by the network.

	Total Cost	2014	2015	2016	2017
ADQUISITION OF EQUIPMENTS AND ACCESORIES	1,222,000.00	328,000.00	298,000.00	298,000.00	298,000.00
INSTALACIÓN Y INICIO DE PRUEBAS	122,625.00	32,700.00	29,975.00	29,975.00	29,975.00
Total	**1,344,625.00**	**360,700.00**	**327,975.00**	**327,975.00**	**327,975.00**





<u>Output 1.2</u>.- A fully operative drought monitoring system based on climate indicators is in place, with required software and quality control of meteorological and climate data developed.

The Dry Arch area is exposed to recurrent droughts in the summer and, although less frequent, to excessive rainfall episodes, both conditions corresponding to climate extremes that affect agriculture and husbandry activities but also food security and water and sanitation. However, while mitigation and preparedness plans to cope with droughts have been designed, their actual implementation is very low and it is hindered by the lack of a functional system to alert the local farmers and local authorities about hazardous climatic trends, as was evident in the drought affecting the area in 2012, which led to a Declaration of National Emergency. Therefore, reliable observation and monitoring systems linked to data management platforms, as well as the implementation of analysis tools for data conversion into information for decision making, are needed to properly characterize this risk.

One of the specific objectives of the ANAM´s championed National Action Programme to combat Desertification and Drought (PAN) is to establish monitoring and forecast systems to confront drought impacts, using tools for continuous monitoring of climatic variables associated with the probability of drought occurrence. Hence, ANAM has developed a set of indicators for drought and land degradation in Panama. This includes the Standardized Precipitation Index (SPI). This is a rainfall monitoring tool that runs based on a single climate variable, allowing the follow up of rainy season, allowing an early identification of drought episodes based on the susceptibility of the target area according to critical values and thresholds of productive activities and other basic issues. This would inform early mitigation and preparedness measures based on such drought trends for the most critical areas.

Through the proposed project, this Index will be generated monthly and automatically to users in the web portal (www.hidromet.com.pa), providing inter-temporal climate forecasts (1, 3 and 6 months) for the dry lands areas, including the Dry Arch. The implementation of Output 1 will be enhanced the climate data resolution for the Dry Arch, which is one of the most complex areas to analyze, according to the pilot analysis performed in 2008 using this Index.

Finally, assessment of extreme climate related impacts in the last several decades for episodes identified by the index, compared with climate scenarios to be developed, aims to evaluate future risk, identify lessons learned and measures to cope with these conditions, as well as act as a guideline of suitable practices for implementation on a long term basis.

<u>Proposed activities</u>

1. Design and implementation of drought monitoring with standard precipitation index (SPI) based on Tonosí and Los Santos climate records and daily rainfall data from the monitoring network.
2. Purchase and installation of the required software and equipment
3. Development of drought impact scenarios based on “analogous” years identified with historical SPI values.
4. Development of guidelines of use for target users of the on line system.
5. Testing and fine tuning of the system.
6. Dissemination of results.

<u>Output 1.3-</u> Climate change scenarios of 25 x 25 km or greater scale resolution focused on vulnerability of main economic activities (agriculture) specifically developed for the Dry Arch area.

The climate change scenarios provide ranges of change of climate variables in relation to current average conditions and for several timelines (2050, 2080, etc.) to which human activities should adapt, but so far, due to relatively low-resolution data, currently available scenarios for Panama are not yet reliable to support decision-making at the level of small towns and rural communities in the Dry Arch.

A new development of climate change scenarios based on the scale proposed through this project output, will support decision-making and implementation of adaptation measures for the target farming communities of the Dry Arch, through a better understanding and knowledge about drought impact, water availability thresholds and/or critical values for current activities in the region associated with different climate patterns and climate change projections.

The methodological needs to develop the climate scenario will be evaluated, and required adjustments will be based on the information needs for the desired scales of analysis. This output will require the combined work between the Hydrometeorology Division of ETESA and the Climate Change Unit of ANAM, under the current Collaboration Accord signed by both institutions. During the process, vulnerability assessments will be complemented with methodologies of participatory assessment of local vulnerability, which will allow combining science-based climate assessments with local knowledge of climate behavior.

Proposed activities

1. Development of climate change scenarios at 25 x 25 km or greater scale resolution.
2. Estimation of future water availability and drought risk under the conditions projected by the climate scenarios.
3. Identification of feasible adaptation practices and measures based on future water availability and lessons learned from past drought conditions.

COMPONENT 2: Enhancing climate resilience of vulnerable farming communities in the Dry Arch

Objective: Enhanced agricultural and water management climate resilient practices in selected vulnerable farming communities in the Dry Arch.

This component aims at reducing current and future vulnerability to climate-induced droughts faced by the farming sector and most vulnerable communities in the Dry Arch. This will be accomplished by enhancing an agro-biodiversity strategy and implementing a set of sound climate resilience practices, focused on land use and water resources management. This component includes four outputs that are targeting concrete tools and measures that were identified and prioritized through a consultative process with local stakeholders and key technical institutions working in the Dry Arch.

Climate change and variability pose a serious threat to food security, production processes, and the quality of life, for the inhabitants of the Dry Arch region. The recent droughts associated to El Niño events have resulted in losses of crops and cattle, and have forced the Government to declare several national emergencies. The declarations of national emergencies were issued in order to access special

funds to cope with the emergency situation. The impact of droughts has limited the agricultural and livestock production, and has damaged the structure and productivity of soils suitable for agriculture, in an area already affected by land degradation and desertification processes. Droughts have affected water and sanitation conditions for the inhabitants of the Dry Arch. Among those most affected by climate change and variability, are rural families who practice subsistence farming. Climate related difficulties for these families were confirmed through the consultation process in the target area, conducted during the proposed project´s formulation.

To reduce the increasing vulnerability of the rural population, innovative agricultural and livestock production practices must be implemented to contribute to food security. By the same token, traditional production practices that are proven to be the most resilient to the effects of climate change, need be encouraged. To help achieve this, the project will support the development of a variety of adaptive production practices that will enable the diversification of food sources and income generation in vulnerable farming communities within the Dry Arch, benefiting a minimum of 300 families within this region. In addition, the project will implement a program to establish water harvesting systems located in critical community infrastructure, such as schools and hospitals, to improve access to water where water delivery infrastructure is currently lacking, and also to provide consistency in supply during drought and water stress conditions in the dry season. Activities supported by AF under this component, will benefit approximately 40 farmer families living on subsistence agriculture; 200 people living in rural communities with limited access to water resources.

Climate change and variability also constitute a threat to the owners of agricultural farms and cattle ranches. One of the main consequences of the recent drought events in the project area was the extensive loss of crops and livestock, which resulted in economic loss for the farm owners. Drought events may also contribute to exacerbate the already serious soil degradation and erosion processes, which limit future production. The project will promote the use of adaptive agro-silvopastoral practices to help framers to cope with natural hazards, particularly droughts, that directly affect agricultural and cattle production in the project area. Adaptive agro-silvopastoral systems will use a combination of practices such as improvement of soils, animal genetics and health, on cattle farming; diversification of forestry uses and design for silvopastoral farms; organic waste management and technologies for silvopastoral efficiency, among others. An additional benefit of the adaptive agro-silvopastoral practices is that these would contribute to improving the production capacity of the region using a more sustainable mode of production adapted to the already fragile environmental conditions of the area.

<u>Output 2.1.</u>- Sustainable silvo-pastoral production and agro-ecological farming practices are implemented vulnerable farms, benefitting1800 families in the Dry Arch

Traditional production practices of natural resources and the profound transformation of ecosystems, which have been based on an “extractive mindset”, have promoted the degradation of the resources that sustain and make possible the agricultural production in the Dry Arch region. With the overall objective of improving conditions for food security in this region, and looking for re-conciliation of the cultural context with productive needs, this proposal aims at integrating silvopastoral activities,

improving techniques and technological inputs for livestock production and also introduces agro-ecological practices into the management of small farms run by vulnerable rural families in the Dry Arch.

It is envisaged that efforts under this output will improve the economy and nutrition of a minimum of 300 poor families by turning "traditional" productive systems, vulnerable to drought episodes, into more sustainable and efficient ones, based on the development of agro-ecological crop gardens composed of goats, cattle, laying hens, plantain and fruit trees, and on acquiring the necessary agriculture tools. The beneficiaries will be able to have agricultural products for self consumption, as well as additional income throughout the year, enhancing their overall adaptive capacities during drought episodes.

At the same time, the output targets a group of 1,500 fruit producers living in poverty and extreme poverty conditions who are facing low levels of production on their farms. The beneficiated communities are located within the Veraguas Province, in an area subject to both drought and heavy rains which affects agriculture and yields. This component focuses on the development of 25 mixed plantations of 1/2 hectares of coffee and fruit trees. This aims at improving livelihood resilience, reforestation of basins and the commercialization of excess production of fruits, together with the improvement of food security for the beneficiated families, who were involved in the design of the proposal. The final goal includes the training of 100 producers and 22 technicians on crops and post harvesting integrated management; the establishment of 32 parcels of plantains under irrigation and innovative practices to be used as centers for the dissemination of technological practices on agriculture, as well as the development of two greenhouses for fruit trees, to be distributed amongst the beneficiaries. As part of this output, a set of environmental and production indicators will be designed to be used to replicate this experience in other areas of the country, exposed to similar hazards and conditions.

Proposed activities
(to be further elaborated in the full-fledged proposal)

Output 2.2. Solar water pumps established in at least 60 vulnerable farms and 50 water harvesting facilities implemented in rural schools and vulnerable indigenous communities in the Dry Arch.

This output consists in the installation of solar water pumps in 60 double-purpose small farming units in the provinces of Herrera (15), Los Santos (15), Coclé (15) and Veraguas (15), located in the Dry Arch of Panama. With the installed systems, local producers will be able to provide water to their cattle and develop small feed crops parcels; enhancing the productivity of their farm during the dry seasons and building resilience for the increasing drought events that affecting the region, which is expected to increase in frequency and severity in the coming years, due to climate change effects. These farms are traditionally double purpose agriculture, typically cultivating rice, maize, beans and sugar cane. The solar water pumps will provide 12 gallons of water/per day/per animal, benefiting directly about 12,000 animals.

Solar water pump systems installed in previous pilot initiatives in the region

The initiative focuses on those farmers that already have wells on their farms that are not being used, due to lack of resources for the installation of the required pumps. This adds to overall difficulties for small scale farmers to bring the electrical network to their farms and/or afford the costs of additional cost of the electricity. With the installed systems, the producers will rely on environmentally friendly renewable sources of energies, avoiding the additional costs of accessing electrical energy, which are not affordable for many of them. This region of the country brings about many comparative advantages for using solar powered systems, in terms of solar intensity and number of hours and days with solar exposure. According to EGESA, (Electrical Generation Company) the annual solar radiation in the Dry Arch is approximately 1,560 kilowatts per square meter, and the level of isolation is 40% superior in comparison the one registered in European countries.[43]

The initiative also builds on previous successful experiences led by the Ministry of Agricultural Development (MIDA), where these types of solar pumps were installed in 60 farms, in 2006, with a robust acceptance from the local producers and provided a sustainable solution to water access problems for 30 producers in the Provinces of Herrera, 20 in Los Santos and ten (10) in Coclé. Between 2008 and 2011, 46 additional systems were installed in Herrera.

This output also targets the limited access to potable water in vulnerable rural communities in the Dry Arch. Through the installation of water harvesting facilities in the rural schools in Coclé, Los Santos, Herrera, Veraguas, and the indigenous autonomous region of Ngöble Buglé ("Comarca"), the project will enhance the adaptive capacity of these communities to more severe and recurrent droughts associated with the projected scenarios of climate change and variability in the Dry Arch. The proposed initiative takes into account the experiences gained and lessons learned by ANAM in recent years, promoting the use of water harvesting systems at an experimental scale, which was very well received by the beneficiaries communities. The focus on schools, as the most adequate location for installing such equipment, is based on the social role that those educational facilities played in rural communities, and the synergies with other disaster risk initiatives fostered by the Ministry of Education (such as "Safe Schools Program" and the implementation of the "School Safety Index"). The students will be the main beneficiaries, being the priority uses of the water for cooking for the

[43] See article in: http://www.s21.com.gt/pulso/2012/08/23/primera-planta-solar-panama-inicia-operaciones-2013

student´s meals, the operation of sanitary facilities, and overall cleaning and maintenance activities of the schools, improving overall water and sanitation conditions

The initiative includes the active involvement of the community in the building works of the facilities, as well as training activities for the correct use the water harvesting system. Based on the community work displayed by ANAM´s local technicians in the area, ten (10) schools in most vulnerable communities in the Provinces of Coclé; Herrera and Los Santos respectively, and 20 schools in the Province of Veraguas and Comarca *Ngöbe Buglé* (a total of 50 schools) have been identified to be the beneficiaries of these systems.

The system is based on a reservoir (a cistern) that stores the water "harvested" through pipes connected to collecting surfaces such as roofs). The project will use cisterns with a storage capacity of 16,000 liters which will be built and installed three meters distance from the schools, using the methodology already tested in previous pilot experiences in indigenous communities as Kuna Yala, Emberá and Ngöble Buglé.

Proposed activities
(To be further developed in the full-fledged proposal)

Output 2.3. - Optimization of four irrigation systems for 150 farms in Coclé Province

Cocle is known as an agricultural province, dedicated to corn and bean production from small farms, as well as extensive crops such as rice, coffee plantations and sugar cane. Despite the relevance of those activities for the national economy and its contribution to the NGP, Coclé faces, together with the eastern region of the Azuero Peninsula, the most adverse situation in the country regarding water availability. With a dry season of no less than five months a year, and a rain average of only 131,7 mm., with an evaporation of 150 mm., the scarcity of water resources in this area is a condition all year around. Hence, there is much demand from the many water users, for the limited water resources available in the Grande river basin, in Coclé (ANAM, 2011[44]; ANAM, 2004[45]).

This Project is aimed at establishing an irrigation system in the Nata and Penonome districts, intending to reduce vulnerability and losses in agriculture due to droughts, as irrigation systems proposed will allow maintaining production in spite of rain scarcity. This will help to increase food security and resilience to climate variability and climate change among rural producers and the local population in general.

This Project will also develop an information system for the environmental evaluation of streams. This activity includes installing measuring mechanisms into the irrigation channels to quantify streams' volumes and design of efficient irrigation systems. Other activities are the waterproof

[44] ANAM, 2011. Atlas Ambiental de la República de Panamá. Gobierno Nacional: Autoridad Nacional del Ambiente (ANAM), Banco Interamericano de Desarrollo (BID).
[45] ANAM, 2004. GEO Panamá. Autoridad Nacional del Ambiente (ANAM); Programa de Naciones Unidas para el Medio Ambiente (PNUMA).

cladding of channels, installing of erosion control and leaking techniques and training on efficient use of water on irrigation systems for users (farmers) and government technicians.

Proposed Activities

(To be further developed in the full-fledged proposal)

Output 2.4.- Participatory Climate Change Adaptation and Disaster Risk Reduction plans produced by five priority Watershed Committees (Santa Maria, La Villa, Parita, Antón and Grande) in the Dry Arch.

As previously mentioned, the Dry Arch is affected by droughts which are usually associated with the occurrence of El Niño events. The low levels of precipitation are translated into lower water levels in the main rivers in this region. This situation is compounded with the increasing demand for human and agricultural water consumption, in a region with a population a relative high density of 45 inhabitants/km^2 (the average population density in the country is 35 inhabitants /km^2). In this context, a robust water governance structure around the water basins as planning units becomes essential to implement an integrated climate resilience and disaster risk reduction strategy.

Panama has a legal a framework with regards to the organization of the Watershed Committees (Law No. 44, 2002), which defines the Committee as a multi-sectoral regional entity, addressing environmental needs of the watershed, with a membership composed by main public sector actors, as well as the civil society that cohabit the watershed defined by ANAM. The Law also establishes that ANAM has the responsibility of organizing these Committees, aiming at des-centralizing the environmental management responsibilities and the sustainable use of the hydrological resources of the country. The establishment of these committees has been delayed, and at some point hampered, due to the lack of a ruling of the Law. In 2012, ANAM conducted a consultation process to approve the regulations of the Law, which was enacted in February 2013. This new regulation body provides a renewed commitment and enthusiasm to advance the implementation of the Watershed Committees.

Backed by this normative framework, and the urgent need to improve the water governance in critical areas such as the Dry Arch, the establishment of the new Watershed Committees provides a unique opportunity to engage local stakeholders in the planning of climate resilient and vulnerability measures in the priority watersheds. The regulation of Law 44 establishes, among the main activities to undertake by the watershed committees, to arrange with the different actors the prioritization of uses and the mechanisms to apply the Environmental Land Use Plans of the water basin, articulating them with other planning instruments such as disaster risk management and adaptation to climate change plans.

The watershed of Rio Parita is located in Herrera Province, with a drainage area of 572 km2 where Rio Parita travels over 70 km until its estuary on the Pacific Ocean. The water basin registers an annual average precipitation of 1692 mm, decreasing from 2.400 mm/year in the central trench of the basin, to 1,000 mm/year in the littoral area. The water basin of the Antón River is located in the SE of Coclé Province, with a total drainage area of 146 km2, and the main river travels 53 km2 until its mouth on the ocean. The water basin registers an annual precipitation of 2,290 mm, decreasing from

3,000 mm in the central part of the basin, to 1,500 mm on the coast. The water basin of the Grande River is also located in Coclé Province, with a total drainage area of 2,515 km^2. The Grande River has a total length of 94 km. This water basin receives an annual precipitation of 3,000 mm/year, decreasing towards the coastal area, where the average precipitation is about 1,500 mm/year. As mentioned before, the watershed presents a heterogeneous spatial distribution in the annual precipitation, with a gradual reduction from the central parts towards the coastal zone. About 96-98% of the annual precipitation falls during the period of March to November, and the remaining 4-2% from December to April.

The other two target water basins belong to two very important and strategic rivers in the Dry Arch. As mentioned before in this proposal, the Santa Maria river water basin was subjected a vulnerability to climate change analysis and there a critical mass of relevant information that could inform an action plan for the Water Basin Committee. La Villa is a strategic river serving many important communities along the Dry Arch and has also been subject of many relevant studies.

Proposed Activities

To be further developed in the full fledged proposal

Output 2.4. Forty (40) Farming Field Schools Centers, including 40 small pilot farms and an institutional supporting network established in the Dry Arch

This output focuses at designing and establishing a capacity building process based on the "**farming field schools"** approach, aiming at strengthening local and institutional capacities that contribute to enhance climate change adaptive capacities for agricultural farms in the Dry Arch.

The Farmer Field School (FFS) is a group-based learning process. During the FFS, farmers carried out experiential learning activities that helped them understand the ecology of their agricultural production. These activities usually involve simple experiments, regular field observations and group analysis. The knowledge gained from these activities enables participants to make their own locally specific decisions about crop management practices[46]. The implementation of projects using the FFS approach led to a deeper understanding of the problem and its causes. One of the weaknesses among the farming sector in the Dry Arch is lack of capabilities for generating, adapting and extending the ecological knowledge within the farming communities themselves, which has often been exacerbated by earlier agricultural development programmes that fostered a dependency on external sources of expertise.

The "farming schools field" approach is being successfully promoted in the Central American region by the Agronomical Tropical Center for Research and Learning (CATIE by its acronym in Spanish). The approach emphasizing the interaction among the farmers, guided by a facilitator (usually a member of the community), who helps to elaborate the learning modules with the philosophy of learning by doing. The focus is promoting and strengthening the farmers' organization capabilities

[46] This approach represents a radical departure from earlier agricultural extension programmes, in which farmers were expected to adopt generalized recommendations that had been formulated by specialists from outside the community

for the developing of a continuous capacity building process, based on the design and implementation of silvo-pastoril systems and livestock good practices management. The FFS integrate learning methods such as experimental and demonstrative plots, field and induction tours, methods demonstrations, farm planning, among others. The planning methodology is the one that will help the farmers and their families to decide on the innovations that they could/should implement to improve the productive and environmental conditions of their farms. The FFS learning approach "producer to producer" increases the success in the adoption of the proposed technologies and it is best suited when the process aims at targeting a large group of farmers.

The FFS will be supported by the development and consolidation of a network of institutions, which will serve as platform for the dissemination of knowledge and successful experiences of sustainable livestock productions. The platform will identify modern means to disseminate the information among the members such as virtual workshops, text messages through mobile phones, scripts for television, radio, etc. A group of technicians from the participating institutions will be trained in the methodology of FFSs and .technical aspects of sustainable livestock production. The trained technicians will be responsible for the training of the FFS´s facilitators established around the group of organized farmers. It is expected that based on the results of this project the network of institutions, with support from CATIE; IDIAP and the Technological University will design a second phase proposal to give continuity and enlarge the number of farmers and initiatives in the rest of the Dry Arch.

This output includes the design of 40 pilot small silvopastoral farms, benefiting from CATIE and IDIAP´s experience in various projects in the region, including the Panama´s Technological Innovations for development of sustainable farms and the Silvo-pastoral FONTAGRO, in the La Villa River basin. The design of these pilot farms includes the implementation of silvopastoral systems, such as soil enrichment, improved pastures with dispersed trees, life fences, foraging banks, small seasonal dams, and good management practices, such as excretes management, protection of water sources, harvesting and production, organic fertilizer modules, bio-digesters, among others. The pilot "model farms" proposed will have a mosaic of land uses that will allow for an enhanced adaptation to the effects of the climate change, especially during drought conditions. Through these 40 pilot farms, the initiative intends to have an impact in an area larger than 800 has in *Sabanas Veraguenses*, Herrera, Los Santos and Coclé, in the Dry Arch.

Proposed Activities
(To be further developed in the full-fledged proposal)

COMPONENT 3: Reducing the vulnerability to climate change and variability in communities located in three vulnerable sub basins of the Panama Canal Watershed.

Objective: reduced vulnerability to flooding, erosion, landslides and droughts associated with climate variability and climate change in communities located in the Chilibre, Chilibrillo and the Trinidad River sub basin, in the Panama Canal Watershed.

This component is designed to strengthen the resilience capacity of the communities within the Chilibre, Chilibrillo and Trinidad river sub basin, to extreme precipitation and drought episodes which are likely to increase according to climate change scenarios and climate vulnerability assessment conducted in the Watershed. These three sub basins were selected as the most vulnerable ones within the Panama Canal Watershed, based on the findings of a climate and socio-economic assessment conducted in 50 sub basins of the Watershed. The objective of the component will be achieved by a series of outputs that combine the implementation of climate resilient land use practices and water management investments.

The Chilibre and Chilibrillo sub basin drain into the middle stream of the Chagres River and are the most populated in the whole Panama Canal Watershed, with an average of 30,360 and 38,221 inhabitants respectively, characterized by a rapid and unplanned urbanization process. As identified in CATHALAC study, the Chilibre and Chilibrillo sub basins present high levels of vulnerability to floods, and in lesser degree, to droughts. The risk is increasing due to the unstable and low water storage capacity of the soils, which can cause erosion, landslides and mudslides associated to heavy rains. The Trinidad River sub basin is part of the east zone of the Panama Canal Watershed with a rural population of 5181 inhabitants dedicated to agricultural subsistence activities based on empirical knowledge of the farmers. According to the same CATHALAC´s study, this sub basin presents a high level of vulnerability to droughts, and in lesser degree, to floods. The risk associated to both hazards is increasing mainly to unsustainable agricultural practices (such as burning and timber of the forest nearby), which is reducing the soil absorption of the water and storage capability.

Previous and current interventions to address the adverse impacts of the water flow levels in the Panama Canal Watershed have been focused on downstream-measures designs to prevent major erosion or flooding. These measures are implemented trough the Environmental Economic Incentive Program (PIEA, by its acronym in Spanish). A broader approach to water management that also addresses upstream measures is considered critical to reduce peak flows and the stress on the current drainage infrastructure. In the same vein, the implementation of sustainable agricultural practices and land use are now pivotal to reduce the climate vulnerability of the communities that live in those areas of the Panama Canal Watershed.

Therefore, Component 3 focuses on reducing the increasing risk of floods and droughts associated to climate variability, exacerbated by climate change, through a set of reforestation programs, which will contribute to prevent erosion and landslides occurrence, while serving as filters to reduce pollution going to water streams. This will have a positive impact on increasing the resilience of the populations improving the water quality and as well as promoting sound territorial planning, in a context of the current urban expansion in the Watershed.

<u>Output 3.1.-</u> At least 400 hectares established under climate resilient agro and silvo-pastoral practices for reduced flood and drought vulnerability in upper parts of Chilibre, Chilibrillo and Trinidad River sub basins

This output aims at implementing reforestation and agroforestal silvo-pastoral system method in the headwaters of riversides and creeks to prevent landslides and flooding in Chilibre and Chilibro sub

basins, as well as improving access to water during drought events in the Trinidad river sub basin. The output will contribute to the overall sanitation and water quality recovery of the three sub basins.

The proposed output will support the establishment of a 200 hectares plot of forest enrichment and agro silvo-pastoral systems in the upper areas of the Chilibre and Chilibrillo sub basins, to avoid that heavy precipitations and related river outflows cause flooding, erosion and landslides, with serious losses. This change in the land use will contribute to prevent erosion and run off of sediments to the water bodies in the Chilibre, Chilibrillo by improving the soil absorption capability in the basin, reducing the sediments and improving freshwater quality parameters.

At the same time, the output envisages the reforestation of 200 hectares in the headwater and water springs of the main creeks and river streams will be implemented in the Trinidad river sub basin. This will to improve water supply for ecosystems and human consumption during dry season in the Trinidad river sub basin.

Activities
(to be further elaborated in the full fledged proposal)

Output 3.2.- At least 50 Farm Management Plans with an integral climate resilient approach established in the Trinidad river sub basin

The project will contribute to implement 50 Farm Management Plans in the Trinidad River which will strengthen the planning capacities climate resilience of the local farmers' productive systems. The methodology for the formulation of these Plans has been developed within the context of the Environmental Economic Incentive Program (PIEA, by its acronym in Spanish), as part of the framework to foster an integrated land use and watershed management approach pursued by the Environmental Division of the ACP.

Through the implementation of the plans this output aims at enhancing the planning changing the culture of land use and related effects of inadequate practices which are the underlying drivers increasing the vulnerability the droughts and floods of the farmer's families in the Trinidad river sub basin. The planning and implementation of climate resilient and sustainable agricultural practices will allow the communities to enhance the soil uses and avoid water pollution, reducing the vulnerability of their livelihoods to the impacts of floods, landslides and droughts.

The Farm Management Plans were designed Programme promote the agro-ecological planning among the beneficiaries of the PIEA Programme, looking for the optimization of farm resources according to their potential, considering endogenous and exogenous factors. With the help of the Adaptation Fund they can be further implemented in 50 vulnerable farms in the Trinidad river sub basin, complementing other actions envisaged in the Output 3. The Farm Management Plans methodology includes eight (8) components which will be reviewed and updated to include relevant disaster risk and adaptation to climate change criteria. At the end of the process every farmer will have a Farm Management Plan elaborated, including detailed information about the actual land uses within the farm and identification of areas with high level of erosion, areas prone to landslides and/or flooding, shown in a map.

The identification of the farms where these plans will be implemented will be undertaken through a pre-selection process based on the following criteria: a) the farms located in the most vulnerable zones of the sub basin according to the CATHALAC´s vulnerability study of the Panama Canal Watershed; b) already "model farms" whose owners have optimally implemented the PIEA, and c) the entrepreneur skills of the beneficiaries.

Activities
(to be further developed in the full fledged proposal)

Output 3.3.- Water harvesting systems in Chilibre, Chilibrillo and Trinidad sub basin have been established for improved water management during drought events.

This output aims at enhancing local water management and water storage capacities for adaptation to increasing drought and water stress conditions in the communities located in the three most vulnerable sub basins the Panama Canal Watershed. El Niño 1997-98 was associated with long dry seasons in the Pacific basin, affecting the drinking water supply, among others economic activities in the country. During the year 1997, the Gatun Lake has water stock of 43% lower than the historic average, reaching in middle March 1998 a level of 78.5 feet (being the critical level at 81.5 feet).

Lack of access to water for human consumption and small agricultural practices is becoming a serious threat in the three target sub basins, which already show high levels of vulnerability to droughts. The increasing population density in these sub basins is not only associated with reduced drinking water supply during the dry season, but also causing the outbreak of waterborne diseases. The prevalent socio-economic vulnerability that characterizes these sub basins compounds the

The focus of the output will be on the establishment of water harvesting systems associated to schools facilities, based on the good pilot experience conducted by ANAM with the installing of these systems in rural schools located in the indigenous "comarcas" (see output 2.3). In despite of the "rural school" emphasis, the initiative will explore diverse water collection and storage alternatives that can be adjusted to the socio-demographic conditions of different parts of the sub basin, specially the urban settings of Chilibre and Chilibrillo, which contrast with the dominant rural context of the Trinidad River sub basin.

As described in Output 2.3., this initiative includes the active involvement of the community in the building works of the facilities, as well as training activities for the correct use the water harvesting system. Based on consultations with the Advisory Councils and Local Committees in the three target sub basins, conducted by the personnel of the Community Development Outreach Division of the ACP, two schools in Chilibre sub basin (Ñajú; San Pablo y Villanueva); two schools in Chilibrillo sub basin and two schools in Trinidad sub basin have been identified as the critical ones to be equipped with water harvesting systems.

Proposed Activities
(to be further developed in the full fledged proposal)

<u>Component 4</u>: Stakeholder processes, knowledge management and climate risk awareness-raising across key institutional drivers and communities targeted in this proposal.

<u>Objective</u>: Key stakeholders in DRR and CCA nationally, and local stakeholders and decision makers in project targeted communities, more visible, networked, informed, equipped and enabled, to affect climate change adaptation and climate smart development and planning, and disseminate good practices for replicability elsewhere.

Stakeholder Processes

At this time, stakeholder processes remain generally quite conventional in Panama. The government, and public interest authorities, such as in the case of Component Three, the Panama Canal Authority, are largely seen, both in terms of within government, and outside of government, to be the party responsible for undertaking climate smart socio-economic development and risk reduction. Additionally, there are a number of international development partners, such as multi-lateral, inter-governmental and bi-lateral donors, as well as international and national non-governmental organizations as well as academic and research institutions active in Panama.

The exponentially increasing demands of adaptation to climate change require a broader stakeholder approach, which is more inclusive and dynamic in nature, than conventional stakeholder processes. Climate change and climate adaptation have some features that make engagement on these topics particularly problematic. These challenges include the presence of misinformation and information overload regarding climate change, people's typical reactions to the inherent uncertainty of future scenario models and projections, and variations in the capacity for long-term planning, as well as other issues.

More specifically, for all key activities of all project components, the following will be considered. The proposed effort will: 1. Understand what nature and degree of engagement is required by different stakeholders; 2. Identify what sorts of information stakeholders need in order to make these decisions; 3. Work towards the development of a protocol for modes of engagement; 4. Develop a framework for monitoring the success of stakeholder communication, engagement, and processes.

Activities will include: a series of scoping interviews with GoP and ACP staff, key external partners and other practitioners in the civil/private/academic sectors; a desktop review of existing stakeholder engagement processes and outcomes; workshops with staff/facilitators experienced in multi-stakeholder engagement; and a report on lessons *learned and good practices.*

Knowledge Management

Knowledge Management (KM) is an emerging and ever-changing field. As such, there are many ways in which KM has been defined, described, deconstructed and analyzed. The field of Knowledge Management has evolved quite uniquely in the private sector, the public sector, inter-governmental and international development agencies, the media and academia. Information and Knowledge Management (KM) enhances integration, sharing and delivery of knowledge as it is a cross-cutting – not a stand-alone – function. Well-managed knowledge systems contribute to improved performance

and outcomes. Knowledge networks, built on shared information, people-to-people connection and collaboration, and enable an organization to effectively and efficiently execute its goals.

Key to knowledge management of climate change adaptation is the mapping out of scientific and experience-based CCA and DRR information and knowledge collected through research activities and on-ground adaption practices. Also key is the identification of knowledge gaps in climate change adaptation that would pose as barriers in undertaking effective adaptation planning and implementing on-the-ground adaptation actions. Panama may wish to develop a national climate change knowledge management platform, building on existing related portals.
Sound KM also works to provide an enabling environment for policies, laws and regulations conducive to the formation, to link research, policy, and 'on the ground' action to blend traditional/indigenous knowledge with science; and to develop certain methods to pass on the local knowledge.

Climate Risk Awareness Raising
Awareness campaigns can address groups of people in a region affected by a particular climate threat, groups of stakeholders, the general public, etc. The ultimate aim is to achieve behavioural changes. Actions which share information about ongoing impact assessments and adaptation activities will lead to a wider range of organizations who are thinking about climate-related problems.

Reducing vulnerability and implementing adaptation measures is not necessarily the task and responsibility of governments. The severity of the climate change requires public and private actors to work together in reducing vulnerability and adapt to the impacts. However, not all stakeholders are aware and informed about their vulnerability and the measures they can take to pro-actively adapt to climate change. Awareness raising is therefore an important component of the adaptation process to manage the impacts of climate change, enhance adaptive capacity, and reduce overall vulnerability.

Public awareness is important to increase enthusiasm and support, stimulate self-mobilisation and action, and mobilise local knowledge and resources. Raising political awareness is important as policy makers and politicians are key actors in the policy process of adaptation. Awareness raising requires strategies of effective communication to reach the desired outcome. The combination of these communication strategies for a targeted audience for a given period can broadly be described as 'awareness raising campaign'. The aim of awareness raising campaigns most often differs between contexts but generally includes increase concern, informing the targeted audience, creating a positive image, and attempts to change their behaviour. Awareness campaigns are considered to be important components in the climate change adaptation science-policy-society interface and in overcoming individual barriers to adaptation, such as skepticism and inaction.

This component proposes four different outputs, targeting concrete aspects of stakeholder processes, knowledge management and awareness raising activities. All these outputs are nurtured and feedback other relevant outputs of the proposal.

Output 4.1- Participatory Stakeholder Processes and Knowledge Management Guidelines

Within the first three months of project implementation, a *Stakeholder Processes and Knowledge Management Workshop* will be held. All persons and parties participating in the project will be invited along with other relevant and interested parties as appropriate. The purpose of this workshop is to both introduce all participants to aspects of stakeholder participation processes and knowledge management as related to project implementation, institutional memory, and information and knowledge sharing locally and international as appropriate. The workshop will allow a personal exchange amongst all project stakeholders, and other parties as appropriate, with the intention of focusing on sound knowledge management as well as on the techniques and methods of multi-stakeholder participation in the project areas. Ideals for stakeholder participation and proven good practices will be presented, challenges will be discussed and realistic mechanisms and processes will be considered by the group. The workshop will generate a simple and concise note – *Stakeholder Processes and Knowledge Management Guidance Note*– specifically developed and tailor-made, for the proposed project´s implementation. One day refresher meetings will be held annually, to allow participants the opportunity for personal exchange and there will also be a final meeting towards the end of the project´s duration, from which a *Lessons Learned and Opportunities Presented Report* will be generated.

Proposed Activities
To be further developed in the full fledged proposal

Output 4.2 - Project Network Established

One of the first activities of the project´s implementation will be the establishment of communications platforms. The specifics of this will be determined in detail in the full proposal, but it is envisaged that there will be a minimum of two electronic platforms. ANAM will host a webpage in Spanish, dedicated to the project, on ANAM´s website. This webpage would be used mainly by people internal to the project. UNDP will also host a dedicated section of the UNDP website to project ongoing, presented in Spanish and English. This information would be mainly for interested people and parties outside of the project. In addition, and in order to capitalize on the results of the *Stakeholder Processes and Knowledge Management Workshop, various networks within the projects participants, in the form of communities of practice, will be established to help foster interaction and information and knowledge sharing.*

Proposed activities
To be further developed in the full fledged proposal

Output 4.3- Project Produced Climate Change Adaptation Training Materials

Training materials (written/ audio/video) including lessons learned from interventions in target areas systematized, suitable for institutional learning, will be produced by ANAM (with participation of stakeholders and project partners). Early after the outset of the project, a production plan for training materials will be developed by ANAM. An expert communications consultant will assist as needed.

During the implementation of this four year effort, various training materials will be produced. Coupling to the timing of planned and prescribed monitoring and evaluation activities, the production of these training materials would ensure that implementation challenges, opportunities, and lessons learned would be incorporated into the substantive training materials thus making them highly realistic. The extensive use of video is planned. All training materials and other documentary media produced will be uploaded, as appropriate, onto the websites as described above. It is also planned than many of the training materials produced will have value for replicability outside of Panama also.

Proposed Activities
To be further developed in the full fledged proposal

Ouput 4.4 - Communication and Public Education Campaign

The wider the circle of people, within a community, knowledgeable about climate change adaptation efforts, the stronger the chances are of sustaining effective action. It is envisaged that the Project Communications and Public Education Campaigns will be developed and managed by the NGO Fundacion Natura.

Although activities related to this ouput will be fully detailed in the full project proposal, the goal of this work will be to ensure that there is both community wide awareness of the project´s work within its surroundings, as well as working with project communities in raising the awareness of the case specific climate change adaptation concerns and action. It is foreseen that there will be a robust interface with other civil society and community groups, including the private sector, as well as youth groups such as young farmers, women´s groups and the local media. ANAM will work closely with Fundacion Natura in an oversight capacity.

Proposed Activities: To be further developed in the full fledged proposal

B. Describe how the project / programme provides economic, social and environmental benefits, with particular reference to the most vulnerable communities, and groups within communities, including gender considerations.

The Project focuses on two areas of Panama, where disaster risk reduction and adaptation to climate change could contribute significantly to economic, social and environmental benefits, especially for target communities and families living with well documented vulnerable socio-economic and environmental conditions. These rural families, who usually rely on non-sustainable agricultural practices, are increasingly threatened by the occurrence of hydro-meteorological hazards, such as droughts and floods, which are eroding their already fragile livelihoods. On one hand, the proposed project addresses climate-related risks in the Dry Arch, an important area for the agricultural sector and food security of the country, characterized by serious environmental degradation processes and the presence of highly vulnerable rural communities to climate variability and climate change. On the other hand, the proposed project includes concrete disaster risk reduction and climate adaptation measures in three sub-basins with high socio-economic vulnerability to climate change and climate variability, within the Panama Canal Watershed. This inter-oceanic watershed is highly populated, and home to many, goods and services important to the whole country. These watershed communities

are facing a rapid and unplanned urbanization process that is leaving the populous at risk of higher exposure to hydro-meteorological hazards.

Component 1 will allow improving the monitoring of climate data and the generation of climate information products for the Dry Arch, bringing direct benefits to all stakeholders, especially producers in the central provinces of Panama (Coclé, Los Santos, Herrera y Veraguas), where the Dry Arch is located. This area of the country is increasingly affected by the impact of hydro-meteorological hazards. Since the droughts associated with El Niño 1997-98, the farm communities in the Dry Arch have seen crops and livestock losses and significant decreases in their productivity over the last two decades. The possibility of establishing a monitoring system to help them to plan ahead and implement effective preparedness and response measures against droughts, will enhance the overall resilience capacities of the rural families in the area, that otherwise depend solely on reactive measures and humanitarian assistance. At the same time, the generation of climate change scenarios with a higher resolution for the Dry Arch, will allow the Government, technical and research institutions to inform the development of policies and planning instruments for adaptation to climate change in the medium and long term for the agricultural sector in the Dry Arch.

Component 2 will bring direct benefits to more than 1,800 farm families located in the Dry Arch, whose livelihoods are based on small agricultural farms. Results will be achieved by introducing and implementing silvo-pastoral and agro-ecological practices resilient to climate change and climate variability. Component 2 focuses on families living at high or extreme poverty levels, who rely on subsistence agriculture, using conventional production methods. The beneficiaries will be able to produce agricultural products for self-consumption, and generate additional income throughout the year, thus enhancing their adaptation capacities during drought events. At the same time, Component 2 will directly benefit 60 small farmers and students from 50 rural schools located in Dry Arch, through the establishment of solar water pumps and water harvesting facilities respectively. Groups of people facing vulnerability in the Dry Arch, are seriously affected by lack of access to water, both for human consumption and for their small agricultural productions, especially during droughts events in the region. Activities under component 2, will be complemented with the socio-economic benefits that will result from the implementation of 40 Farm Schools as well as the disaster risk reduction and adaptation to climate change plans that will be developed in five vulnerable water basins by the recently established Watershed Councils.

Component 3 will bring direct socio-economic benefits to 74.000 inhabitants located in the three most vulnerable sub-basins in the Panama Canal Watershed; with indirect benefits to almost 80% the Panamanians living in Panama´s Canal Watershed. The sub basin of the rivers Chilibre and Chilibrillo, which waters drain to the middle stream of the Chagres River, present significant social and environmental problems, related to the pattern of rapid and unplanned urban development. As a result, there is lack of access to drinking water, garbage collection system, electricity services, among others. This section of the basin affects bodies of water within the whole Panama Canal Watershed. Risk increases as banks are unstable with low water storage capacity in soil, which can cause erosion, landslides and mudslides associated to the high precipitation that can produce harm to margin urban housing, urban infrastructures and roads. Additionally, the excess of waste may cause stagnation of wastewater, increasing risk of water-related disease.

Component 3 also includes interventions in the sub-basin of Trinidad River, which has a population of 5,181 living in rural housing with high levels of poverty. The main economic activity is agriculture, characterized by subsistence farming and extensive practices using low technology, based on empirical knowledge of farmers. Increasing levels of vulnerability to droughts (and to a lesser degree, floods), have been identified in this sub basin, in part due to the practice of felling and burning of nearby forests. This factor, added to the already fragmented vegetative cover is causing

loss of absorption and storage capability, in soils, thus increasing the impact of drought episodes in the sub basin. Component 3 of the project would improve the absorptive capacity of the soil in the Watershed, increase access to water for human consumption and improve land use planning in the three targeted sub basins, thus reducing levels of climate risk and enhancing climate resilience to recurrent drought and flood events. The use of good agriculture practices will allow the communities to enhance soil use and avoid pollution, so that the collateral effects caused by flooding, landslides and drought would be largely prevented.

The four components will bring significant environmental benefits in all intervention areas of the project. In the Dry Arch, the set of silvo-pastoral and agro-ecological initiatives, as well as the action plans for disaster risk reduction and adaptation to climate change at the sub basin level, will contribute to reduce soil degradation and desertification processes and improve the overall resilience of the water basins. The use of clean technologies and environmentally friendly systems, such as solar water pumps and water harvesting systems, will bring low impact, sustainable solutions to the chronic lack of access to water and related problems in the region, which are being exacerbated by extreme climate variability events and climate change. At the same time, even though the quantification of environmental benefits provided by the Farm Schools cannot be assessed at this point, they will obviously contribute to promote a cultural shift from an extractive culture strongly rooted in the area, towards one relying on sustainable technologies and rational use of resources, in harmony with the preservation of the environment.

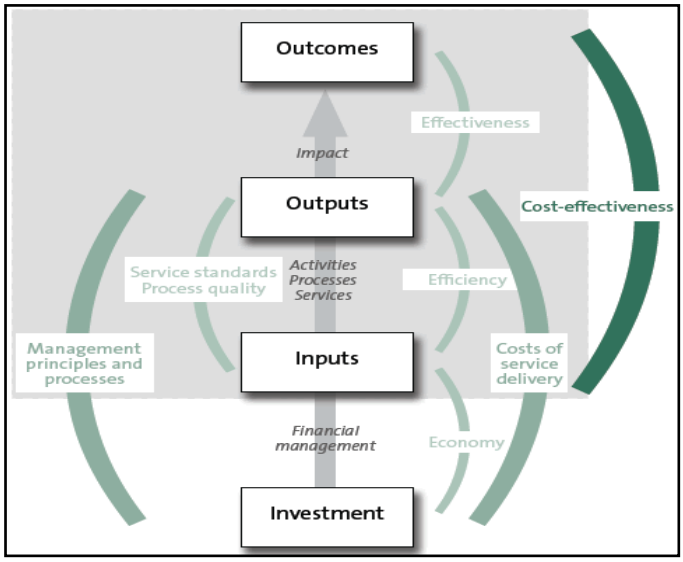
C. Describe or provide an analysis of the cost-effectiveness of the proposed project / programme.

In introducing aspects of cost effectiveness of the proposed project, it is firstly defined as follows. Cost-effectiveness of the project / programme is done in comparison to other possible interventions. Also to be considered at a fundamental level, and especially important in terms of adaptation efforts, is the cost of the intended action versus the costs (in this case referring to negative aspects) of inaction. Qualitative information is useful at this level, as quantitative data is highly difficult to estimate and project in this case.

The cost-effectiveness of a project is made up of effectiveness and efficiency – that is, the relationship between inputs, outputs, and outcomes. At its simplest, cost-effectiveness is about the relationship between the investment – the input of dollars and resources – to the result, or the impact or outcome achieved. While impact measures gauge a more direct effect of a project´s activities and services: cost-effectiveness reflects the value for money of these services. For services to be truly effective, they must also be cost-effective, and achieve a positive impact at an affordable price. Similarly, the cost-effectiveness of services, initiatives, and other outputs are important matters for stakeholders to consider in determining where and when to invest resources, and when and how to adjust their strategies or change aspects of implementation (see Figure next page). The project will provide direct solutions to problems associated to the increasing impact of droughts and floods in the target areas, benefiting directly more than 2,500 families in the Dry Arch area, and 74,000 people living in vulnerable communities in the Panama Canal Watershed. Additionally, through the incorporation of climate risk management considerations into municipal planning tools the project will provide long-term benefits to people living in five priority water basins in the Dry Arch. The project favors an integrated approach between disaster risk management and adaptation to climate change, taking advantages of the synergies between the two fields of knowledge and avoids

duplication and dispersion of both agendas. This project will integrate the efforts of various institutions around risk reduction objectives focused on droughts and floods, while advancing goals of adaptation to climate change, ensuring a most cost-effective approach for the country.

Outcomes model, indicating cost-effectiveness measures



http://www.oag.govt.nz/2011/improving-annual-reports/part4.htm

Also, while the Government of Panama considers this project an initial catalytic step towards providing solutions to climate change-related threats in the project target areas, it will be potentially replicated and up-scaled to provide other areas in the country with multiple adaptation benefits. In that sense, Component 4 of this proposal will be a key contribution to scale up the specific interventions and benefit other parts of the country with enhanced adaptive knowledge and capacities. Thus, the AF investment will have a significant impact in areas of the country that are vulnerable to droughts and floods that in recent years has seen a significant increase in both the size of the area impacted and the duration of the effects of the impacts, as a result of climate change and variability The Government does not consider the "cost of doing nothing", as this would represent undermining the productive bases of agricultural sector which is well represented in the Dry Arch with serious consequences for small farmers which play a key role in food security of rural and growing large urban centers of the country. The increasing cost associated to emergency response and rehabilitation in the target areas, forcing the Government to implement budget-reallocations, prompt the need to implement more sustainable solutions such as those proposed in this project.

Within the detailed project proposal forthcoming, a thorough cost effective analysis will be undertaken. In meeting the challenge how much to invest in gathering and analyzing the data that will help to determine cost-effectiveness, the project will consider ways of achieving this data collection that are the most efficient possible, using available information as much as is possible. Looking specifically at the anticipated cost-effectiveness of the proposed project, a brief overview of the aspects of cost effectiveness is presented, as associated with the planned outputs of each project component. Aspects of implementation, social, economic, and environmental cost effectives are briefly outlined in the table below.

COST-EFFECTIVENESS of Project Design and Implementation					
Proposed Project Output	**Implementation Aspects**	**Social Aspects**	**Econonmic Aspects**	**Environmental Aspects**	**Remarks**
1.1. Network of hydro-meterological stations in the Dry Arch is strengthened through the modernization of 67 stations and installation of 21 new stations.	Existing facilities and services will largely be built upon, thus taking into account previous good practices and lessons learned while thinking innovative expansions at the same time. In terms of implementation, emphasis will be placed on getting the optimal value, for quality work and installations with long term, and low maintenance, sustainability in mind.	Local authorities will be involved and will operate and maintain the new and expanded installations. This will help to advance local skills and knowledge in this area. The establishment of this modernized network of hydro-meteorological stations in the Dry Arch, would be highly cost effective in terms of assisting all stakeholders in land use planning, in disaster risk management generally, and in planning for immediate and longer term adaptation needs.	Local capacity for monitoring hydrometeorology is important for the many economic considerations associated with drought and floods, and climate variability. This will continue to become increasingly important in the context of climate change	No adverse environmental effects. This output will help with gaining more robust information about meteorology and facilitate the generation of more robust environmental /natural resource data.	Currently in Panama, there is no data collection system regularized for climate information needs for multiple users, including ANAM. The data collected will be stored as part of ETESA´s hydro-climatological system and shared with ANAM as part of its environmental information system, and hence can be readily integrated into existing and readily used infrastructure and processes, including early warning systems.
1.2. A fully operative drought monitoring system based on climate indicators is in place, with required software and quality control of meteorological and climate data developed.	Seeing as this is the installation of a drought monitoring system where currently none exists, practitioners will look to other like-minded efforts for lessons learned and good practices recommended. Implementation experiences will be recorded. Locally procured products will be used as much as possible. Materials will be sourced based on value and prices competitively. Locals will be employed as much as possible	Local authorities will be involved and will operate and maintain the drought monitoring system. This will help to advance local skills and knowledge in this area. Since the clients will indirectly be the local farmers, they will be made aware of this and will be active stakeholders thus strengthened the sustainability of drought monitoring.	Drought monitoring informs markets, informs planning, and generally provides a better understanding of drought. Drought monitoring helps to reveal in advance, what infrastructure, supplies and services will be needed to avert negative consequences, and is thus critical for assessing and planning for local economic conditions.	Monitoring drought also informs environmental reporting and helps assess climate change. The results associated with this output will inform communities on drought and thus help to alleviate drought-related environmental issues.	Drought monitoring will become increasingly important in the context of climate change. In the larger picture, drought monitoring is highly cost effective for sustainable livelihoods. The demands for, and supply of, climate information continues to increase, thus all efforts addressing this challenge will be sound investments.

	for implementation and maintenance				
1.3. Climate change scenarios of 25 x 25 km or greater scale resolution focused on vulnerability of agricultural activities is specifically developed for the Dry Arch area.	Although there has been progress towards generating the data needed to develop climate change scenarios, the proposed action will ensure that this is achieved in a timely manner and for the areas which are highly vulnerable.	As the scope of the scenarios are local, capacity building will be generated at the local level with stakeholders. The skills and services required to undertake small scale CC scenarios will be increasingly important. Climate scenarios developed with inclusion of all stakeholders, will increase community-wide awareness, participation and ownership.	Climate Scenarios is highly cost effective for limiting losses and ensuring more adequate coping measures, as it allows much greater lead time within a higher resolution context.	Climate related policies, strategies and plans can all use realistic projections to inform their efforts –especially important in medium and longer term sustainable development planning. Projections also inform integrative natural resource management.	Climate Change scenarios are a critical step in planning. Due to climate variability and climate change, past records no longer allow specific distinctions in climate predictability . At the outset of the project, outreach should be prioritized to link with like minded efforts to ensure no duplication and also to build on existing and pipelined programmes/projects. The cost effectiveness gained from successfully approximated predicted scenarios is extensive and touches on all aspects of policy development, legislation, and land use and development planning.
2.1. Sustainable silvo-pastoral production practices and agro-ecological farming are implemented in the Dry Arch, benefiting 1,800 of vulnerable rural families.	In terms of information and knowledge sharing, as part of the implementation plan, the proposed action includes the establishment of parcels under irrigation and innovative practices, to be used, as centers for knowledge dissemination.	Social cost effectiveness includes improving livelihood resilience, together with the improvement of food security for the beneficiated families, who were also involved in the design of the proposal.	Value for economic investment will be cost effective because the investment will allow poor farm families to enhance their incomes, throughout the year, on a sustainable basis. It will also allow the commercialization of any excess production of fruits.	A set of environmental and production indicators will be designed to be used to replicate this experience in other areas of the country, exposed to similar hazards and conditions.	Multi-crop farms will become increasingly important as climate change and variability affect individual species thus making monoculture more vulnerable. The importance of increasing biodiversity as well as carbon sequestration vis a vi silvo-culture, are

					also important considerations.
2.2. Solar water pumps established in at least 60 vulnerable farms and 50 water harvesting facilities implemented in rural schools and vulnerable indigenous communities in the Dry Arch.	The initiative focuses on those farmers that already have wells on their farms that are not being used due to an inability to afford electric or fuel pumps, so it builds upon existing infrastructure. The goods and services supported by the project will be selected based on quality long term and low maintenance operation, as well as on economic considerations. Locally accessed materials will be considered when possible. The initiative also builds on previous successful experiences led by the Ministry of Agricultural Development (MIDA) and takes into account the experiences gained and lessons learned by ANAM.	This output also targets the limited access to potable water in vulnerable rural communities in the Dry Arch. Through the installation of water harvesting facilities in the rural schools in Coclé, Los Santos, Herrera, Veraguas, and the indigenous autonomous region of Ngöble Buglé ("Comarca"), the project will enhance the adaptive capacity of these communities. The focus on schools, is based on the social role that those educational facilities played in rural communities, and the synergies with other disaster risk initiatives fostered by the Ministry of Education.	For the beneficiaries, the pumps will enhance the productivity of participating farms during the dry seasons. With climate change, water shortages will become increasingly common, installing a system is likely to also make a property more valuable.	The system for catchment is based on a reservoir (a cistern) that stores the water "harvested" through pipes connected to collecting surfaces such as roofs).	
2.3. Optimization of four irrigation systems for 150 farms in Coclé Province	Goods and services funded by the project will be selected based on quality long term and low maintenance operation, as well as on economic considerations. Locally accessed materials, labour and services will be prioritized.	This will help to increase food security and resilience to climate variability and climate change among rural producers and the local population in general.	Reduces vulnerability and losses in agriculture due to droughts, as irrigation systems proposed will allow maintaining production in spite of rain scarcity.	This Project will also develop an information system for the environmental evaluation of streams. This activity includes installing measuring mechanisms into the irrigation channels to quantify streams' volumes and design of efficient irrigation systems.	Local capacity increased by the training on efficient use of water on irrigation systems for users (farmers) and government technicians.

2.4. Participatory Climate Change Adaptation and Disaster Risk Reduction plans produced by five priority Watershed Committees (Santa Maria, La Villa, Parita, Antón and Grande) in the Dry Arch.	Building on existing data, the Santa Maria River water basin was subjected a vulnerability to climate change analysis and there is a critical mass of relevant information that could inform an action plans for the Water Basin Committee. La Villa is a strategic river serving many important communities within the Dry Arch and has also been the subject of many relevant studies. This proposed action builds upon Law 44 which establishes, among the main activities to be undertaken by the watershed committees, which is to arrange, with the different actors, the prioritization of uses and the mechanisms to apply the Environmental Land Use Plans of the water basin, articulating them with other planning instruments such as disaster risk management and adaptation to climate change plans.	Public awareness and public participation will all target communities to be fully involved in the projects final design details, implementation and evaluation. Experiences in mulit-stakeholder process will be documented and shared.	The watersheds selected are economically very important for sustaining adequate water flows for other uses and for agriculture, which significantly contributes to livelihoods and food security.	Environmental information will be supplemented with this effort. Linking CCA with DRR will help integrate plans for more embracing climate-smart development.	A robust water governance structure around the water basins as planning units, is essential to implement a integrated climate resilience and disaster risk reduction strategy. This will become increasingly important over time, so an immediate investment is an advantage as this will allow all farmers and other stakeholders to begin working with DRR/climate information and including it within decision making and planning.
2.5- Forty (40) Farming Field Schools, including 40 small pilot farms and an institutional supporting network established in the Dry Arch	This output benefits from CATIE and IDIAP´s experience in various projects in the region, including Panama´s Technological Innovations for development of sustainable farms and the Silvo-pastoral FONTAGRO, in the La Villa River basin.	This output focuses on designing and establishing a capacity building process based on the "farming field schools" approach, aimed at strengthening local and institutional capacities that contribute to enhance climate change adaptive capacities for	The planning methodology is the one that will help the farmers and their families to decide on the innovations that they could/should implement to improve the productive of their farms.	The methodology is oriented towards sustainability in terms of how to improve environmental conditions of farms. The design of these pilot farms includes the implementation of silvo-pastoral systems, such as	The approach emphasizing the interaction among the farmers, guided by a facilitator (usually a member of the community), who helps to elaborate the learning modules with the philosophy of learning by

		agricultural farms in the Dry Arch.		soil enrichment, improved pastures with dispersed trees, living fences, foraging banks, small seasonal dams, and good management practices, such as waste management, protection of water sources, harvesting and production, organic fertilizer modules, and bio-digesters.	doing.
3.1. At least 400 hectares under climate resilient agricultural practices established in Chilibre, Chilibro, and Trinidad River sub basin	Local resources and labour will be used. Local capacity will be built. Project implementation processes will be recorded and shared.	Working towards the alleviation of flood and landslide impact, this effort works towards lessening lives lost and other social losses. The output will also contribute to water quality recovery of the three sub basins serving populations in these and adjacent areas as well as improve access to water during drought events in the Trinidad River sub basin.	This output works to avoid the impact of heavy precipitation and related river outflows, which cause flooding, erosion and landslides, and usually serious livelihoods, property and other economic losses.	This change in the land use will contribute to prevent erosion and run off of sediments to the water bodies in the Chilibre, Chilibrillo by improving the soil absorption capability in the basin, reducing the sediments and improving freshwater quality parameters. Activities in reforestation will contribute towards, soil stabilization and quality, the maintenance of biodiversity and carbon sequestration.	Agricultural resilience supports economic resilience, social and ecological resilience, and is the key driver for sustainable livelihoods in the Dry Arch of Panama. The information generated from climate change scenarios in the Dry Arch (Output 1.3) will positively impact agriculture, allowing producers to prepare for the demands, challenges and opportunities of future years.
3.2. At least 50 Farm Management Plans with an integral climate resilient approach established in the Trinidad river sub basin.	The identification of the farms where these plans will be implemented will be undertaken through a pre-selection process based on the following criteria: a) the farms located in the most vulnerable zones of the sub	Through the implementation of the plans this output aims at enhancing the planning, changing the culture of land use and related effects of inadequate practices which are the	This effort will strengthen the planning capacities for climate resilience of the local farmers' productive systems. Planning will better allow for sound economic farm management as well as	The methodology for the formulation of these Plans has been developed within the context of the Environmental Economic Incentive Program, as part of the framework to	By delineating more precision for farms adapting to climate change and variability, improved targeting and value for programs is more easily achieved, as are better defined

	basin according to the CATHALAC´s vulnerability study of the Panama Canal Watershed; b) already "model farms" whose owners have optimally implemented the PIEA, and c) the entrepreneur skills of the beneficiaries.	underlying drivers increasing the vulnerability the droughts and floods of the farmer's families in the Trinidad river sub basin.	helping to mitigate economic losses.	foster an integrated land use and watershed management approach pursued by the Environmental Division of the ACP.	resiliency plans. The Farm Management Plans methodology includes eight (8) components which will be reviewed and updated to include relevant disaster risk and adaptation to climate change criteria.
3.3. Water harvesting systems for improved water management during drought events have been established in Chilibre, Chilibrillo and Trinidad sub basin	The proposed output is based on consultations with the Advisory Councils and Local Committees in the three target sub basins, conducted by the personnel of the Community Development Outreach Division of the ACP. The harvesting systems will be designed and built based on much inherent knowledge and previous experiences, in rural Panama.	This initiative includes the active involvement of the community in the building works of the facilities, as well as training activities for the correct use the water harvesting system. , two schools in Chilibre sub basin; two schools in Chilibrillo sub basin and two schools in Trinidad sub basin have been identified as the critical ones to be equipped with water harvesting systems.	At a foundational level, it is of course, highly cost effective to collect rainwater, a completely free source, than for either a public authority or private enterprise or individual to pay for supplied water, as a monthly or periodic recurrent cost.	From an environmental perspective, water catchment is beneficial as it takes water, much of which would be run off, and contains it, and conserves it for later use when needed. Water catchment helps to lessen the demand for underground water extraction also, which benefits the environment. There would very negligible, in any, environmental impact from building the catchments and cisterns.	Climate change will make water harvesting increasingly important. The increasing population density in these sub basins is not only associated with reduced drinking water supply during the dry season, but also causing the outbreak of waterborne diseases.
4.1.Participatory Stakeholder Processes and Knowledge Management Guidelines	For continuity, implementation is designed with one day refresher meetings to be held annually, to allow participants the opportunity for personal exchange. There will also be a final meeting towards the end of the project´s duration, from which a *Lessons Learned and Opportunities Presented Report* will be generated.	This capacity building effort will allow a personal exchange amongst all project stakeholders, and other parties as appropriate, with the intention of focusing on sound knowledge management as well as on the techniques and methods of multi-stakeholder participation in the project areas.	Multi-stakeholder participation from all sectors and groups will quickly illuminate areas of duplication, thus saving resources. It will also allow for all the stakeholder groups to contribute products, services and expertise all of economic value. With the economically oriented sectors participating more	Participatory multi-stakeholder processes will help link environmental concerns with DRR, CCA and other sectors and groups.	The exponentially increasing demands of adaptation to climate change require a broader stakeholder approach, which is more inclusive and dynamic in nature, than conventional stakeholder processes

			focus will be placed on ensuring DRR and CCA efforts can be translated into real cost savings, important for political ownership.		
4.2. Project Network Established	It is envisaged that there will be a minimum of two electronic platforms. ANAM will host a webpage in Spanish, dedicated to the project, on ANAM´s website. This webpage would be used mainly by people internal to the project. UNDP will also host a dedicated section of the UNDP website to project ongoing, presented in Spanish and English. This information would be mainly for interested people and parties outside of the project.	In order to capitalize on the results of the Stakeholder Processes and Knowledge Management Workshop, various networks within the projects participants, in the form of communities of practice, will be established to help foster interaction and information and knowledge sharing.	Establishing a project network virtually will help to connect people without costs. The more networked the CCA/DRR and other sectors, the less chances of duplication of similar efforts thus representing resource savings.	This network will help to link environmental considerations with DRR and CCA.	It is intended that the networks established during the life cycle of the proposed action will be valued and thus sustained post completion.
4.3 Project Produced Climate Change Adaptation Training Materials	During the implementation of this four year effort, various training materials will be produced.	All training materials and other documentary media produced will be uploaded, as appropriate, onto the websites as described above. It is also planned than many of the training materials produced will have value for replicability outside of Panama also. This will benefit greater numbers of people within and beyond the project communities.	Coupling to the timing of planned and prescribed monitoring and evaluation activities, the production of these training materials would ensure that implementation challenges, opportunities, and lessons learned would be incorporated into the substantive training materials thus making them highly realistic, thus ensuring economic cost effectiveness.	Links with environmental aspects related to DRR and CCA will be strengthened.	As climate change advances, information will become increasingly complex, so making headway in training in climate change adaptation at the outset, will empower and inform stakeholders and decision makers.
4.4 Communication and Public Education Campaign	It is foreseen that during implementation there will be	Not all stakeholders are aware and informed about	Raising economic considerations of investing	Associations with environmental	The severity of the climate change requires

	a robust interface with other civil society and community groups, including the private sector, as well as youth groups such as young farmers, women´s groups and the local media.	their vulnerability and the measures they can take to pro-actively adapt to climate change. Awareness raising is therefore an important component of the adaptation process to manage the impacts of climate change, enhance adaptive capacity, and reduce overall vulnerability.	in DRR and CCA within public awareness, is important as policy makers and politicians are key actors in the financial aspects of the policy and legislative related processes of DRR and adaptation.	considerations related to DRR and CCA will be enhanced.	public and private actors to work together in reducing vulnerability and adapt to the impacts.

D. Describe how the project / programme is consistent with national or sub-national sustainable development strategies, including, where appropriate, national or sub-national development plans, poverty reduction strategies, sector strategies, national communications, or national adaptation programs of action, or other relevant instruments, where they exist.

This proposal is consistent with policies and national programs that show the commitment of the Government to address the adaptation to climate change and disaster risk reduction issues, the reduction of poverty and the diminish of natural resources degradation. Also is consistent with the Climate Change National Policy, Integrated Water Resources Management Policy, National Comprehensive Disaster Risk Management Policy and national policy guidelines on food security.

The project is consistent with the objectives established by the National Climate Change Policy, enacted in 2007, which includes promoting climate adaptation actions compatible with protection of the population and fight against poverty (Objective 2), as well the strengthening of institutional capacities and citizens participation to confront the adverse impacts of climate change (Objectives 4 and 5). This National Policy has recently been updated through a nationwide participatory process that took place in 2012. The new version, already endorsed by ANAM[47]; has special focus on adaptation to climate change and disaster risk reduction, in compliance with the harmonization between policy frameworks for adaptation to climate change and disaster risk reduction mandated by the National Comprehensive Disaster Risk Management Policy (PNGIRD, by its acronym in Spanish). The PNGIRD was approved in December 2010 and includes a section on "environment and climate change" as one of the five policy pillars, promoting an integrated approach for disaster risk reduction and adaptation to climate change in all relevant policy and programmatic frameworks (such as the integrated water resources management field). Additionally, the overall objectives of the four components of this proposal are in line with the strategic action lines set by the Panamanian National Committee on Climate Change (CONACPP, by its acronym in Spanish). CONACCP was established in 2009, to guide the efforts of the institutions towards the implementation of the National Climate Change Policy, among other aspects of environmental management. The target areas of this proposal were identified and prioritized with the active dialogue within the CONACCP.

The Integrated Water Resources Management Policy has been recently updated (Executive Decree No. 480, April 2013), incorporating explicit dimensions of climate change adaptation and disaster risk reduction in its contents. The regulatory body for the Watershed Law 2006 approved by Executive Decree No. 479 (April 2013) considers, among the roles and responsibilities of the governance structures and planning instruments for watershed management, relevant dimensions of disaster risk reduction and adaptation to climate change (such as risk and climate change vulnerability assessments). The envisaged outputs in this proposal are in line with the implementation of this updated legal framework. The project is also consistent with the National Plan of Integrated Management of Water Resources of the Republic of Panama 2010-2030, Chapter 6 related to Climate Change, risk management and vulnerability.

[47] The updated version has been endorsed by ANAM in February 2013, and it is expected to be enacted trough an Executive Decree in the first half of 2013.

Objective under Component 1 are consistent with the actions established in the National Climate Change Policy, which states "strengthen climate observation networks for monitoring parameters and indicators of climate change" (source), as well as by the findings and strategic recommendations coming from the Second National Communication, on research and systematic observation matters. The outputs outlined under this component are also consistent with the objectives of the Technical Accord between ANAM and ETESA, focusing on enhancing the climate information baseline and climate information products.

Objectives under Component 2 are consistent with the National Strategy for the Agriculture Sector, which contemplates plans, programs and training geared toward the modernization of rural productive systems, development of organic farming and food security. The objectives of the proposal are also aligned with various initiatives focused on the target areas, such as the Rural Productivity Project (PRORURAL, by its acronym in Spanish), and FONTAGRO. PRORURAL aims at improving the life conditions of the rural population and small rural farmers organized in the central provinces (Los Santos, Herrera and Veraguas) and their actions lines are consistent with the outputs identified in the proposal for the Adaptation Fund in the Dry Arch.

Outputs under Component Three of this proposal are consistent with the ACP environmental strategy that integrates social, economics, and environmental aspects, strengthening by an inter-institutional coordination and strategic alliances for the achievement of connectivity and continuity of the natural system, the community tissue and production activities. The Environmental Strategy is implemented through the Institutional Commission of Panama Watershed Basin (ClCH, for its acronym in Spanish). The CICH gather efforts, initiatives, and resources for the conservation and management of the Basin, and promotes the sustainable development. As a part of this process, a Master Plan was established with a vision to 25 years to facilitate a set of ordered and concerted actions called "Sustainable Development Plan and lntegrated Water Resources Management of the Panama Canal Watershed (Plan DS-GlRH, for its acronyms in Spanish). The DS-GIRH focuses on enhancing the quality of life of the population located in the poorest rural areas of the Panama Canal Watershed. It is worthwhile Chilibre, Chilibrillo and Trinidad sub-basins were identified among the eight sub-basins prioritized for the project. Also, the project is complementary to the Environmental Economic Incentives Program (PIEA, for its acronym in Spanish) that promotes good farming practices through the development of sustainable environmental business in the Canal Basin.

The overall objective and outputs under Component 4 of this proposal are consistent with objectives (objective 3, established in the National Policy for Climate Change. and priority strategic guidelines established in the Second National Communication (SNC), which highlight the urgent needs to improve education, training and public awareness on climate change related issues, as well as a special emphasis in capacity building. In particular, outputs identified under Component 4 are explicitly tackling one of the main problems captured in the SNC, which is the *"lack of a culture of documentation, recording and provision of information, both meteorological and social that could*

relate to climatic aspects"[48]. Additionally, the Project is consistent with the ACP Capacity Building Plan, which includes capacity building to enable local committees, teachers and students.

E. Describe how the project / programme meets relevant national technical standards, where applicable, such as standards for environmental assessment, building codes, etc.

The national technical standards applicable to Component 1 are specifically linked to the guidelines and protocols for the production of hydro-meteorological information established by ETESA and aligned with the standards recommended by the World Meteorological Organization. These include: *Manual for the Operation, Inspection, and Maintenance of Meteorological Stations*. Also, to the standards set in the international *Guide to Meteorological Instruments and Methods of Observation*, the World Meteorological Organization (WMO document) and other international standards. Additionally, the

The other components, the project will meet the national standards related to environmental land use planning and the new regulations established for integrated water resources management. Also it will fulfill the requirements for environmental studies and regulation standards for waste management, best agriculture practices, and drinking water quality. The project accomplishes the environmental requirements established in Environmental Law 1998, and Environmental Assessment Process in Law No.123 of 2009 and its modifications,

UNDP would be fully accountable for the effective implementation of this project. As a Multilateral Implementing Entity, UNDP is responsible for providing a number of key general management and specialized technical support services. These services are provided through UNDP's global network of country, regional, and headquarters offices and units and include assistance in project formulation and appraisal; determination of execution modality and local capacity assessment; briefing and de-briefing of project staff and consultants; general oversight and monitoring, including participation in project reviews; receipt, allocation, and reporting to the donor of financial resources; thematic and technical backstopping; provision of systems, IT infrastructure, branding, and knowledge transfer; research and development; participation in policy negotiations; policy advisory services; programme identification and development; identifying, accessing, combining and sequencing financing; troubleshooting; identification and consolidation of learning; and training and capacity building.

F. Describe if there is duplication of project / programme with other funding sources, if any.

There is no duplication with other funding sources. Panama has currently no other specific funding sources for reducing the vulnerability of communities in the target areas to flooding and droughts, and for building resilience and climate change adaptation capacity. The project builds upon national policies for Climate Change, Disaster Risk Reduction, and investments to ensure the incorporation of cost effective, state of the art adaptation measures, thus ensuring the complementarily of national investments with the financing provided by the Adaptation Fund.

[48] Second National Communication: Executive Summary, ANAM. 2012. (page. 23).

The proposed project will create synergies and coordinate action with other related initiatives. Efforts will not be duplicated but rather will be complemented by incorporating adaptation measures to climate change into the planning and programming of these initiatives. During the project design phase, efforts have been made to fully identify potential coordination mechanisms with all relevant ongoing or planned initiatives; these efforts will continue during the implementation phase of this project.

The project also builds on lessons learned and good practices systematized by the UN Joint Programme *Integration of Climate Change Adaptation and Mitigation Measures in the Management of Natural Resources in Two Priority Watershed,* finalized in 2012 and which was implemented in two priority watershed in country (Chucunaque y Tabasará)**.** The overall aim of this programme financed was to increase the capacity for adaptation and mitigation to climate change and to contribute to environmental sustainability and poverty reduction in these two priority watersheds in Panama. The Joint Programme focused on areas with high levels of land degradation, pressure on land and water resources, vulnerability to climate change and poverty. It promoted the implementation of sustainable land management and optimal water usage, particularly in agricultural and forestry sectors, the development of a Climate Change Adaptation and Mitigation Strategy, Climate Monitoring System, Early Warning System, climate change awareness campaigns, and increasing the sources of funding. Details can be found in the MDG Achievement Fund official website (http://www.wiki.mdgfund.net).

G. If applicable, describe the learning and knowledge management component to capture and disseminate lessons learned.

Knowledge Management, including data management, experiential learning, recording processes and lessons learned for institutional memory, for organizational learning and for inclusive dissemination and knowledge exchanges, is an important part of the proposed project.

Building Local Level Knowledge Management Capacity

In terms of information and knowledge exchanges at the local level, the proposed project will help to ensure that local authorities and decision makers, along with vulnerable farmers and community populations in the targeted areas of Panama have a more thorough understanding of climate variability and climate change, along with its likely impacts, for their community. Knowledge exchanges will be undertaken regarding the range of measures to enhance resilience to flooding and drought and to maintain community wide food and water security. Additionally, local level, as well as national level decision makers and practitioners, will become more familiar with the importance of undertaking climate smart development, and particularly land use, planning.

KM features prominently in Component Four, which has as its main goal that key stakeholders in DRR and CCA nationally, and local stakeholders and decision makers in project targeted communities, are made more visible, networked, informed, equipped and enabled, to affect climate change adaptation and climate smart development and planning, and disseminate good practices for replicability elsewhere. It also includes specific activities to strengthen Environmental Education and Knowledge Management in the Chilibre- Chilibrillo and Trinidad River Sub basins. The existing

platform established by the CICH of community participatory mechanism held by local committee and adviser counsels, enhance the opportunities of knowledge transfer and disseminate lessons learned within the project to other areas in the country.

KM efforts throughout the project´s lifecycle

The project envisages numerous KM activities throughout the project cycle. Following project preparation, a specific KM plan and communication strategy will be prepared for information and knowledge management and dissemination of lessons learned at different levels. KM outputs of the planned project include guidelines and manuals, training materials including videos, baseline information and assessments of site specific target areas, workshops, experiential training, site visits, peer to peer knowledge exchange events, websites and other web based platforms, and also progress and monitoring reports and evaluations. The capturing and analyzing of experience, success factors, good practice and lessons learned will be systematically applied throughout the project cycle, for example from site specific detailed assessments through data and information useful for climate smart land use and development planning. In the third year of the project, a national level KM workshop will be convened to review the knowledge management and tools used, and coordination KM practices implemented in the project, as well as to develop a KM strategy for sustaining on-going efforts and for replication in similar future efforts in Panama, as well as elsewhere in the region and beyond.

Sharing Lessons Learned and Replicating Good Practices

The project will identify and participate, as relevant and appropriate, in meetings and networks, which will be of benefit to support the exchange of lessons learned and good practice. Recognizing the importance of Knowledge Management (KM) to enhance impacts and facilitate replication, this initiative integrates various KM related actions. Lessons learned will be documented by project staff with the support of the Project Director. These will be disseminated through a number of appropriate means to various target audiences and be guided by a project communication strategy. The project plans to implement knowledge management (KM) mechanisms and dissemination of lessons learned from a local to national and international levels. At the local level, a participatory approach will be embraced within the development and dissemination of information and knowledge sharing materials. The intended project sites will contribute, from the outset and regularly thereafter, to the sharing of lessons, information, knowledge and experience through local dissemination. The project will publish and disseminate knowledge about traditional and new adaptation measures, which have been applied in productive lands impacted by hydro-meteorological events. The systematized lessons learned will also be shared in the web-based *Adaptation Learning Mechanism* (ALM) to ensure wide dissemination.

H. Describe the consultative process, including the list of stakeholders consulted, undertaken during project preparation, with particular reference to vulnerable groups, including gender considerations.

In July 2012, under the initiative of the National Environmental Authority (ANAM), the Panamanian National Committee for Climate Change (CONACCP, by its acronyms in Spanish), convened a special consultative session to explore the basis for developing a concept note proposal for the

Adaptation Fund, and identify potential priority geographical and thematic areas to address. As a result of this first consultation with sixteen representatives from key national stakeholders represented in CONACCP it was recommended that the development of the proposal should focus on land use and water management issues in the Dry Arch of the country and the Pacific sector of the Panama Canal Watershed.

Based on those broad guidelines from CONACCP, ANAM organized a series of workshops in the Dry Arch region to identify the main adaptation problems, relevant on-going initiatives and discuss priority approaches for climate change adaptation in the area. In the case of the Panama Canal Watershed, the proposal relies on a previous consultation work undertaken by the Canal Panama Authority, in the context of the climate vulnerability assessment commissioned in 2011 which was the basis for CATHALAC study.

For the consultation in the Dry Arch, ANAM organized regional parallel workshops in the Provinces of Coclé, Veraguas, Los Santos and Herrera, which took place at the end of September 2012. The methodology for the workshops included separate sessions with three different affiliation groups for each Province: a) Group of NGOs; b) Group of Local Producers; c) Group of Public Institutions. Each session included an induction section introducing the goals and scope of the proposals for the Adaptation Fund. The workshop in Los Santos (26 of September), was attended by the Governor of the Province, who endorsed the importance of implementing climate change adaptation measures in the Dry Arch. Coclé. The workshops in Veraguas and Herrera were held on 25 of September, and the workshop in Coclé was took place on 25. Annex XX presents a summary of the workshop findings and the lists of participants.

In the case of the Panama Canal Watershed, as part of the preparation of the vulnerability assessment, six workshops were organized in 2011 by the "Team of Relations with Community of the Watershed", part of the Environmental Division of The Panama Canal Authority. Five workshops were held in the western sector of the Watershed, in the following communities: (a) El Lirio (11 August, 2011); (b) Hules, Tinajones y Caño Quebrado, Chorrera (16 August, 2011); (c) High trench, Cirí Grande (17 August, 2011), (d) Middle-low trench Cirí Grande, Los Faldares, (25 August, 2011); (e) Middle-low Trench Trinidad, El Cacao (26 August, 2011). The last workshop was held in the region of Pacific Sector of Transistmic Corridor, in all trenches of the sub basins of Chilibre and Chilibrillo rivers.

Through these series of workshops, 155 members of the local committee, which 85 were male and 70 were female, were trained in basic concepts of climate, threats, vulnerability and climate change. In the Annexes of this proposal are attached the results of the workshops held in the sub basin of Chilibre and Chilibrillo Rivers and the sub Basin of Trinidad River. In Addition, this proposal have been validated in the Adviser Councils held on November Mt'2012, and was accepted by the parties.

I. Provide justification for funding requested, focusing on the full cost of adaptation reasoning.

Significant changes in climate are already visible globally, and are associated with wide ranging impacts on the natural and man-made environment across different sectors and regions. These impacts are leading to significant social, ecological and economic costs. Without taking climate stabilizing action, these costs of climate change impact are known as the 'costs of inaction' and once estimated, are increasingly helping to inform policy debate and decision making.

To allow a fully informed debate on adaptation, there is a need to fully consider the various cost aspects of adaptation. Although full quantitative articulation of socio-economic and environmental costs of inaction, as compared to taking adaptation measures, remains a challenge beyond our reach, efforts towards this goal are paramount. Socio-economic cost benefit analysis and environmental impact assessments for implementing adaptation measures will not only inform policy development but are also foundational and elemental to garnishing government support for the sustainability of adaptation efforts.

The proposed project will be supported by fully trained expert economists, as an in-kind contribution from the Government of Panama and the Panama Canal Authority. They will examine economic aspects associated with both climate and socio-economic projections; issues of valuation (market and non-market effects; indirect effects on the economy); spatial and temporal variation (discounting and distributional effects); uncertainty and irreversibility (especially in relation to large-scale irreversible events); and coverage (which climate parameters, and which impact categories, are included). They will also factor in the economic considerations of the projects planned adaptation measures, including aspects of the type of adaptation (autonomous or planned); the level and timing of adaptation (e.g. anticipatory or reactive); the types of costs of adaptation (including direct costs and transition costs); the ancillary benefits of adaptation; and the distributional aspects of adaptation. A record of these observations and recommendations, from an economic perspective will be maintained and disseminated as appropriate, as part of the project´s knowledge management activities.

For each of the four project components, the baseline costs (without Adaptation Fund resources) as compared to projected adaptation costs and cost savings of the planned measures (with Adaptation Fund resources) will be carefully reviewed. This baseline information will be captured at the outset of the project. During the project´s monitoring and especially during its evaluation, the full socio-economic and environmental costs of adaptation will be recorded, as will estimates of costs of inaction. This socio-economic focus will help to ensure continued financial support from the government to assist in sustaining adaptation and DRR efforts in Panama.

The objective of the activities proposed for the priority sub basins in the Panama Canal Watershed has a vulnerability reduction approach and the same time consider some adaptation measure to climate change, such as agriculture sustainable practices, reforestation in threat areas to drought and flooding, among other; allowing them to be consider in activities addressing climate change issues in the Basin. So, this program can be duplicated in other sub basins that have "high" level of vulnerability. The approach of the associated cost to the presence of extreme events, without

implementing measure for reduction vulnerability in the Basin, is based in the secondary information that allows relying on a range of values that suggest the impact magnitude. However, it is recommended to develop a valorization of the primary cost of not doing action against the vulnerability to climate variability in the priority sub basins in order to analyze a proposal that address avoided cost vs. cost incurred.

During the years 1997 and 1998, the presence of "El Niño" caused in Panama long dry seasons in the Pacific Coast, and flooding in the Caribbean Coast, mainly affecting important economic activities such as: agricultural production, tourism, fishery, hydroelectric generation, drinking water supply, health, etc. The drought in the Pacific coast is consider the most intense in the last 50 years, lowered the water levels of the main lakes that provide storage for the generation of electricity and drinking water (Mitigating the effects of "El Niño": Study Case of agriculture sector, Central America, 2002).

The Panama Canal Watershed also was affected by the scarcity of precipitation. During the year 1997, the Gatun Lake had a hydrological stock of 43% lower than the historic average, reaching in middle March of 1998 a level of 78.5 feet, becoming the most critical level at 81.5 feet. The Alhajuela Lake, that supplies water to Panama city, had in 1997 a stock of water just of 36% comparing to 60 years of record under the elevation at 1793.8 mm.

As part of the saving of water measures in the year 1997 there Was not generation of electricity in the Gatun lake, and diminishing of the availability of the water resources in some areas of the urban sectors. The Panama Commission at that time developed a series of additional measures, including the restriction of the draft of vessels from a period of 109 days, starting from March 12, 1998. According to Morieri J. (1998, p.10), it is estimated that in direct way the Panama Commission spent US$. 12 million to mitigate the effects of drought through dredging, port adaptation, interruption in hydroelectric energy generation, studies, etc.

In other hand, at the end of the year 2010, when is dry normally and start summer season in Panama, the accumulative effect of several extraordinary rainfall induced by the weather phenomenon of "La Niña" that has opposite effects than "El Niño", generated the mayor precipitation in the last 10 years, causing for the first time a temporary closing of the Panama Canal. By this, after a month of strong rains, the Alhajuela and Gatun Lakes reached the highest level in history. As reported by National Civil Protection System (SINAPROC by its acronyms in Spanish) the most harmed areas in it whole by this event were the province of Panama, Colón, Darien and Chiriquí. In the Panama City, the drinking water supply was closed by the problems caused to the Drinking Water Plant in Chilibre, reducing it production capacity to 30%. The expenses incurred by IDAAN (by its acronyms in Spanish) to face the situation, including chemicals cost, water distribution by trucks, extra personal, reached approximately US$ 10 million, which has to be added to the repairing of the Water Treatment Plant that have not been included yet.

The closing of the Panama Canal represented a loss of daily incomes of approximately US$ 5,403, 021 (ACP, 2010. Financial Statement of Audit Reports, page 5). This value, may not consider the expenses incurred for attending the causes of closing, even the cost associated to the delay in the Shipping Companies because of the closing of the water route.

J. Describe how the sustainability of the project/programme outcomes has been taken into account when designing the project.

The detailed description of financial, social, environmental and institutional sustainability of the project will be fully addressed in the final proposal. Following there are some of the main elements related to the sustainability of the project expected results.

In general, the sustainability of project results is based on the incorporation of the specific outputs of this proposal into the programmatic activities of the various institutions directly involved in the project. For example, in Component 1, the new hydro-meteorological stations to be installed will become part of the national network of hydro-meteorological stations, managed and maintained by ETESA Hydrometeorology Division. Similarly, the drought monitoring system will become part of climate products provided by ETESA through its web site. MIDA´s technical network in the Dry Arch will provide support to ensure the dissemination of the results of the Standardized Precipitation Index (SPI), ensuring the communicating of the SPI results in a format and a language accessible to local farmers. The monitoring system will also inform drought preparedness activities in neighboring areas prone to droughts, in addition to the targeted areas in the Dry Arch.

In the case of Component 2, the active involvement of MIDA and IDIAP in activities that are also part of broad programmatic objectives of the work of these institutions in the Dry Arch is a reassurance of continuity and replicability of project´s results in other relevant territorial areas where these institutions work. Furthermore, several of the activities of Component 2 are being included as part of a National Plan for Disaster Risk Management which MIDA is advancing. Similarly, the technical support from CATIE, through current and envisaged working partnerships with MIDA and IDIAP, is also a reassurance of continuity of project´s results for this particular component. The involvement of the Technological University of Panama will contribute significantly to the engagement of the research and academia communities in the further continuity of the project´s results. And finally, the field schools established through this project component will be the best guarantee of continuity and sustainability of results, through the active involvement and empowerment of local farmers throughout the whole Dry Arch.

For Component 3, the project design takes into account the sustainability of the project results to consider other programs that reinforce the activities to be developed and to use local resources and platforms such as the Local Committees and Advisory Councils organized and operating in Basin, which are participatory mechanism underlying the success and sustainability of the proposal within the Canal Basin. Furthermore, the Environmental Economic Incentives Program (PIEA by its acronyms in Spanish) promotes the generation of good practice through the development of environmentally sustainable business in Panama Canal Watershed. During the period 2008-2011, more than 650 producers from over 38 villages in the sub-basins of Cirí Large, Rubber Tinajones and Canoa Quebrada, have benefited from the PIEA. The project design take into account the sustainability of the program outcomes by considering other programs that enforce the activities to be developed and using the local resources and existing platforms such as the local Committee and the Advisory Councils of the Watershed, which are the participatory mechanism for the Project success

and sustainability within the Panama Canal Watershed. The Economic Environmental Incentive Program (PIEA by its acronyms in Spanish) promotes the good production practices, through the development of sustainable environmental business in the Panama Canal Watershed. During the period 2OO8-2O11, 659 farmers from more than 38 towns of the sub basin of Ciri Grandre, Hules Tinajones and Caño Quebrado, have been profited in increasing their production by using the model of planning of farms that establishes the program.

The program implementation is complemented by the execution of other projects related to environmental protection those managed by the civil society through the mechanism established the Sustainable Development Plan for the integrated management of hydraulic resources (Plan DS-GIRH by its acronyms in Spanish). The Ciri Grande and Trinidad Region gather the larger amount of projects (9), which have been financed by the FIDECO fund that manages the Natura Foundation.

PART III: IMPLEMENTATION ARRANGEMENTS

A. Describe the arrangements for project / programme implementation.

(to be further elaborated after final consultation with institutions)

The GoC will execute the project with the support of the UNDP under the **National Implementation Modality** (NIM). ANAM will be the Executing Entity responsible for ensuring that the objectives and components of the project are delivered, and that resources are allocated and disbursed in an efficient and effective manner. The ANAM will have the technical and administrative responsibility for applying AF inputs in order to reach the expected Outcomes/Outputs as defined in this project document. The ANAM will be responsible for the timely delivery of project inputs and outputs, and in this context, for the coordination of all other responsible parties, including other government agencies, regional and local government authorities.

Upon the request of the Government of Panama, UNDP will serve as the Multilateral Implementing Entity for this project. Services that UNDP will provide to the Implementing Partner in support of achieving project Outcomes/Outputs are outlined in Annex A. UNDP's services will be provided by staff in the UNDP Country Office (Panama City), UNDP Regional Centre for Latin American and the Caribbean (Panama City, Panama), and UNDP Headquarters (New York).

UNDP will provide support to the National Project Director and the Project Coordinator in order to maximize its reach and impact as well as for the delivery of quality products. Moreover, it will be responsible for administering resources in accordance with the specific objectives defined in the Project Document, and in keeping with its key principles of transparency, competitiveness, efficiency, and economy. The financial management and accountability for the resources allocated, as well as other activities related to the execution of project activities, will be undertaken under the supervision of the UNDP Country Office (UNDP CO) with the UNDP's Regional Technical Advisor in Panama. UNDP will undertake the internal monitoring of the project and of evaluation activities, taking into account from the outset local capacities for administering the project, capacity limitations and requirements, as well as the effectiveness and efficiency of communications between all institutions that are relevant to the project.

As outlined in UNDP's application to the AF Board for accreditation as a Multilateral Implementing Entity, UNDP employs a number of project execution modalities determined on country demand, the specificities of an intervention, and a country context. Under the NIM proposed for the project, UNDP selects a government entity as the Executing Entity based on relevant capacity assessments performed by UNDP. The Executing Entity is the agency entrusted with and fully accountable to UNDP for successfully managing and delivering project outputs. It is responsible to UNDP for activities including: the preparation and implementation of project work plans and annual audit plans; preparation and operation of project budgets and budget revisions; disbursement and administration of funds; recruitment of national and international consultants and project personnel; financial and progress reporting; and monitoring and evaluation. However, as stated above, UNDP retains ultimate accountability for the effective implementation of the project

Implementation of the project will be carried out under the general guidance of a **Project Steering Committee** (PSC). The PSC will be responsible for approving key management decisions of the project and will play a critical role in assuring the technical quality, financial transparency and overall development impact of the project. The PSC will be composed of designated senior-level representatives from the ACP; ETESA; MIDA; IDIAP; Universidad Tecnológica, CATIE and Fundación Natura. A complete list of PSC members and their designated alternates will be provided in the inception report. Terms of Reference (ToRs) for the PSC will be developed for the full-fledged proposal.

Implementation of the project will be carried out under the general guidance of a **Project Steering Committee** (PSC). The PSC will be responsible for approving key management decisions of the project and will play a critical role in assuring the technical quality, financial transparency and overall development impact of the project.

B. Describe the measures for financial and project / programme risk management.

Key risks underlying the project will be analyzed during the formulation phase in connection with the target sites of the project. Over the course of the project, a UNDP risk log will be regularly updated in intervals of no less than every six months in which critical risks to the project have been identified. The risks facing the project and the risk mitigation strategy (countermeasures) will be described in the full-fledged proposal and summarized as below:

No	Type	Risk Description	Level	Mitigation Strategy
1	Political			
2	Institutional			
3	Regulatory			
4	Operational			
5	Financial			

A comprehensive risk management strategy will be a core component of project management activities. This is in line with UNDP's stringent risk management approach which is corporate policy. The respective UNDP CO provides support to the project team and executing agency for constant and consistent risk monitoring, and the results are tracked and reported in UNDP's internal risk monitoring system. Risks will be entered into the UNDP's Atlas (project management system) and will be systematically monitored as part of the M&E process by UNDP staff carrying out their oversight related tasks. The results are also reported in the yearly evaluation undertaken for each project. In addition to this, and again in keeping with UNDP practice, a dedicated budget line exists for Monitoring and Evaluation (M&E), to ensure that the necessary resources are allocated to execute the M&E framework.

C. Describe the monitoring and evaluation arrangements and provide a budgeted M&E plan. Include break-down of how Implementing Entity's fees will be utilized in the supervision of the monitoring and evaluation function.

The objectives, outcomes, outputs and indicators of the proposed action, are aligned with the Adaptation Fund´s Strategic Results Framework. Planned activities for Results Based Management (RBM), monitoring and evaluation will follow the guidance of the Adaptation Fund´s Evaluation Framework, and will be in keeping with the following guiding principles. RBM, monitoring and evaluation activities will:

- be implemented stepwise, applying lessons learned in further planning, monitoring and evaluation;
- align with a limited number of timely, reliable and cost effective indicators, both qualitative and quantitative, providing simple and reliable means to measure achievements and reporting performance;
- be integrated into the project cycle (a project evaluation will be conducted at the end of implementation of the project);
- be as simple as possible while commensurable with the resources available;
- help to integrate learning and knowledge management into the project cycle; and
- help ensure that the roles and uses of performance information are well defined for accountability and knowledge generation and dissemination.

There will be several levels of monitoring and evaluation. Monitoring and evaluation will be undertaken in accordance with the regular, established monitoring procedures of the MIE, UNDP, and will be carried out by the project team under the oversight of the UNDP Panama Country Office. Support from technical and programme management UNDP staff in the UNDP Panama Regional Center, as well as at UNDP New York Headquarters, will be regularly provided.

Monitoring and evaluation will also be aligned with the Adaptation Fund´s Operational Procedures and Guidelines (OPG); and Results Based Management (RBM) approach. The suggested monitoring and evaluation activities, as outlined in the Adaptation Funds Evaluation Framework, will be planned. The proposed effort, once ongoing, will also adhere to the Adaptation Fund´s Project Performance Reporting (PPR) structure and template.

The logical framework, when finalized in the detailed proposal, and when confirmed and/or refined, as is necessary, with the stakeholders upon project inception, will be the main instrument to follow up the achievement of the expected results, especially through indicators and sources of verification.

Monitoring and Evaluation Mechanisms

Project Inception Workshop: This will be held within the first two to three months of the project start. Persons who, and organizations which, have assigned roles and responsibilities in the project organization structure, staff from the UNDP Panama Country Office, as well as UNDP Regional Technical Advisors and other stakeholders and experts as appropriate, will contribute to the Inception

Workshop, which is important for building ownership and for developing the project´s first annual work plan. The Inception Workshop will also identify members for the Project´s Steering Committee and Technical Advisory Group. Furthermore, the Inception Workshop will help clarify roles and responsibilities, reporting and communication lines, decision-making structures and processes, and financial reporting procedures, obligations, and arrangements for financial and management audits. Specifically to M&E, the Inception Workshop is very important for confirming or refining project indicators, targets and their means of verification, developing a detailed overview of the reporting, monitoring and evaluation (M&E) requirements, and for confirming agreement on an M&E work plan and budget. An Inception Report will be prepared, disseminated, and annexed to the signed project document, thus formalizing agreements and plans, generated from the Workshop.

Periodic monitoring through site visits: The Government of Panama, the Project Steering Committee and Technical Advisory Group, the UNDP Panama CO, the UNDP Regional Office and other project participants and/stakeholders as is agreed, will conduct visits to project sites based on the schedule as planned in the project's Inception Report/Annual Work Plan. A brief field site monitoring report, aligned with the PPR, will be prepared by UNDP for circulation, within two weeks after the visit. At this time, it is foreseen that sites visits will be undertaken at a maximum monthly, and at a minimum bi-annually, depending on the needs and specifics of each of the project sites.

Quarterly monitoring mechanisms: Quarterly Progress Reports will be prepared by the Project team and verified by the Project Board. Based on the initial risk analysis submitted, a risk log will be updated in ATLAS quarterly. Risks will be considered critical when the impact and probability are high (more than 50%). To avoid duplication of tasks, it is noted that the Project Progress Reports (PPR) can be generated based on the information recorded in Atlas. Other ATLAS logs can be used to help monitor issues, as well as to record qualitative information and processes, lessons learned and suggested good practices.

Annual monitoring mechanisms: Annual Project Reviews (APR) are key reports which are prepared to monitor progress. UNDP will assess the quality of APRs through an external consultant, who will oversee the APR´s completeness, comprehensiveness, analytical rigor and lessons learned. The APR includes, but is not limited to, reporting on the following: (a) progress made toward project objective and project outcomes (cumulative); (b) project outputs delivered per project outcome (annual); (c) lesson learned/good practices; (d) AWP and other expenditure reports; and (e) risk, adaptive management and organizational learning.

Mid-Term External Evaluation Twenty-four months into the four year proposed action, which will represent the mid-point of project implementation, an external evaluation will be conducted to determine progress being made toward the achievement of outcomes and to identify corrective action if needed. It will focus on the efficiency, effectiveness, and timeliness of project implementation. Issues requiring actions will be noted, as will present initial lessons learned about all aspects of project design, implementation, and management to date. Findings of this review will be disseminated to project stakeholders and the recommendations for enhanced implementation will then be undertaken during the final two years of the project.

Final Evaluation and Project Terminal Report: An independent and external Final Evaluation will be conducted two to three months prior to project closure. This evaluation will focus on the delivery of the project's results and will focus on the project´s impact and the sustainability of results, including the contribution to capacity development. During the last three months, the project team will prepare the Project Terminal Report. This comprehensive report will summarize the results achieved (Objectives, Outcomes, Outputs), challenges encountered, lessons learned, met and areas where results may not have been fully achieved. It will also lay out recommendations for any further steps that may need to be taken to ensure sustainability and replicability.

Type of M&E activity	Responsible Parties	Budget (USD)	Time frame
Inception Workshop	Project Coordinator UNDP-CO	15,000	Within 60 days of project start up
Inception Report	Project team UNDP-CO	None	Within 30 days of the Inception Workshop
Measurement of Means of Verification of project results.	Oversight by Project Coordinator Project team	None	Annually
Measurement of Means of Verification for Project Progress and Performance	Project Coordinator Project Team	None	Annually
Quarterly Reports	Project Coordinator Project Team	None	Quarterly
Annual Reports	Project Coordinator Project Team UNDP CO Executing Agency with Input from Stakeholders External Consultant	8,000	Year end of each year.
Meetings of the Project Steering Committee	Project Coordinator UNDP-CO	None	Project Inception, Bi-annually during implementation
Meetings of the Technical Advisory Committee	Project Coordinator Project Team External Consultant	8,000	To be determined by Project Team and UNDP CO
Mid-term External Evaluation	Project Coordinator Project Team UNDP-CO External Consultant	16,000	Mid-point of implementation.
Final External Evaluation	Project Coordinator Project Team UNDP-CO External Consultant	22,000	Upon project completion.
Final Report	Project Coordinator	None	Within the final 30 days

	Project Team UNDP-CO		of project implementation.
Site Visits	Project coordinator Project Team Steering Committee Technical Advisory Committee Government Representatives UNDP-CO	18,000	Minimum bi-annually and at a maximum monthly depending on the site specifics
Lessons Learned Reports	Project Team Steering Committee External Consultant	12,000	Yearly
Audit External	External Consultant/ UN Auditors UNDP CO Project Coordinator Project Team	12,000	In accordance with UNDP procedures
TOTAL INDICATIVE COST		**111,000**	

D. Include a results framework for the project proposal, including milestones, targets and indicators and sex-disaggregate targets and indicators, as appropriate. The project or programme results framework should align with the goal and impact of the Adaptation Fund and should include at least one of the core outcome indicators from the AF's results framework that are applicable[49].

A detailed results framework with SMART indicators, their baseline and targets will be prepared during the preparation of the full Project Document to be submitted to the Adaptation Fund for approval. The table below shows the alignment of the planned results of the proposal with the goals of the Adaptation Funds.

CROSS COMPARISON OF THE GOALS OF THE ADAPTATION FUND AND EXPECTED RESULTS THE PROPOSED PROJECT	
EXPECTED RESULTS OF THE ADAPTATION FUND	RELEVANT CONTRIBUTIONS FROM THE PROPOSED PROJECT´S PLANNED GOALS AND RESULTS
Goal: Assist developing-country Parties	The overall goal of the proposed project is to:

[49] Please refer to the *Project level results framework and baseline guidance* for the Adaptation Fund's results framework and guidance on developing a results framework and establishing a baseline [add link here].

to the Kyoto Protocol that are particularly vulnerable to the adverse effects of climate change in meeting the costs of concrete adaptation projects and programmes in order to implement climate-resilient measures.	"reduce vulnerability to the adverse effects of climate change and variability in the most vulnerable communities in the Dry Arch and Panama Canal Watershed, in the Central Pacific Region of Panama."
Outcome 1: Reduced exposure at national level to climate-related hazards and threats	
Outcome 2: Strengthened institutional capacity to reduce risks associated with climate-induced socioeconomic and environmental losses	Output 1.1. Network of hydro-meteorological stations in the Dry Arch is strengthened through the modernization of 67 stations and installation of 21 new stations, improving the climate information baseline for climate research, monitoring and early warning needs. Output 1.2. A fully operative drought monitoring system based on climate indicators is in place, with required software and quality control of meteorological and climate data developed. Output 2.4. Participatory Climate Change Adaptation and Disaster Risk Reduction plans produced by five priority Watershed Committees (Parita, Antón, Grande, La Villa and Santa María) in the Dry Arch.
Outcome 3: Strengthened awareness and ownership of adaptation and climate risk reduction processes at local level.	Output 4.1: Guidelines on multi-stakeholders participatory processes and knowledge management produced
Outcome 4: Increased adaptive capacity within relevant development and natural resource sectors	Output 2.2. Solar water pumps established in at least 60 vulnerable farms and water harvesting facilities implemented in50 rural schools in the Dry Arch Output 3.3.- Two water harvesting programs in Chilibre, Chilibrillo and a water storage infrastructure in Trinidad sub basin have been established for improved water management during drought events.
Outcome 5 : Increased ecosystem resilience in response to climate change and variability-induced stress	Output 3.1.- At least 400 hectares established under climate resilient agro and silvo-pastoral practices for reduced flood and drought vulnerability in upper parts of Chilibre, Chilibrillo

	and Trinidad River sub basins
Outcome 6: Diversified and strengthened livelihoods and sources of income for vulnerable people in targeted areas	Output 1.3 Climate change scenarios of 25x25 km or greater scale resolution focused on vulnerability of main economic activities (agriculture and husbandry) specifically developed for the Dry Arch area. Output 2.1. Sustainable silvo-pastoral production practices and agro-ecological farming are implemented in the Dry Arch Output 2.3. Optimization of irrigation systems in XX (farmers/ has.) in Coclé Province Output 3.1.- At least 400 hectares established under climate resilient agro and silvo-pastoral practices for reduced flood and drought vulnerability in upper parts of Chilibre, Chilibrillo and Trinidad River sub basins Output 3.2.- At least 50 Farm Management Plans with an integral climate resilient approach established in the Trinidad river sub basin Output 2.5. –. Forty (40) Farm Schools, 20 pilot model farms and an institutional supporting network established in the Dry Arch
Outcome 7: Improved policies and regulations that promote and enforce resilience measures	

E. Include a detailed budget with budget notes, a budget on the Implementing Entity management fee use, and an explanation and a breakdown of the execution costs.

To be included in the full-fledged proposal

F. Include a disbursement schedule with time-bound milestones.

To be included in the full-fledged proposal

PART IV: ENDORSEMENT BY GOVERNMENT AND CERTIFICATION BY THE IMPLEMENTING ENTITY

A. RECORD OF ENDORSEMENT ON BEHALF OF THE GOVERNMENT[50] *Provide the name and position of the government official and indicate date of endorsement. If this is a regional project/programme, list the endorsing officials all the participating countries. The endorsement letter(s) should be attached as an annex to the project/programme proposal. Please attach the endorsement letter(s) with this template; add as many participating governments if a regional project/programme:*

(Enter Name, Position, Ministry) *Silvano Vergara, Administrator, National Environmental Authority, ANAM*	Date*: (Month, day, year)*

[6.] Each Party shall designate and communicate to the Secretariat the authority that will endorse on behalf of the national government the projects and programmes proposed by the implementing entities.

Letter of Endorsement by Government

[Government Letter Head]

[Date of Endorsement Letter]

To: The Adaptation Fund Board
c/o Adaptation Fund Board Secretariat
Email: Secretariat@Adaptation-Fund.org
Fax: 202 522 3240/5

Subject: Endorsement for [Title of Project/Programme]

In my capacity as designated authority for the Adaptation Fund in [country], I confirm that the above (select national or regional) project/programme proposal is in accordance with the government's (select national or regional) priorities in implementing adaptation activities to reduce adverse impacts of, and risks, posed by climate change in the (select country or region).

Accordingly, I am pleased to endorse the above project/programme proposal with support from the Adaptation Fund. If approved, the project/programme will be implemented by [implementing entity] and executed by [national or local executing entity].

Sincerely,

[Name of Designated Government Official]
[Position/Title in Government]

B. IMPLEMENTING ENTITY CERTIFICATION *Provide the name and signature of the Implementing Entity Coordinator and the date of signature. Provide also the project/programme contact person's name, telephone number and email address*

I certify that this proposal has been prepared in accordance with guidelines provided by the Adaptation Fund Board, and prevailing National Development and Adaptation Plans (……list here…..) and subject to the approval by the Adaptation Fund Board, understands that the Implementing Entity will be fully (legally and financially) responsible for the implementation of this project/programme.	
Name & Signature Implementing Entity Coordinator	
Date: *(Month, Day, Year)*	Tel. and email:
Project Contact Person:	
Tel. And Email:	

ANNEXES

Autoridad Nacional del Ambiente
Dirección de Gestión Integrada de Cuencas Hidrográficas
Unidad de Cambio Climático y Desertificación

Talleres de Consulta en Herrera y Los Santos para la Formulación de un proyecto de adaptación (25 y 26 de septiembre de 2012) (Informe)

1. Antecedentes

En la primera Conferencia de las Partes de la Convención Maraco de las Naciones Unidas sobre Cambio Climático (CMNUCC) en 1996, se introduce el financiamiento para la adaptación, como tema de la agenda de negociación de dicha Convención. Luego del proceso de negociación, la decisión concreta se adopta en el año 2001 (COP7); lográndose la creación de dicho fondo por las Partes del Protocolo de Kioto de la CMNUCC, para el financiamiento de actividades relacionadas con la adaptación en países en desarrollo, denominado Fondo Especial sobre Cambio Climático o Fondo de Adaptación.

Panamá, como país parte de la convención y signatario del Protocolo de Kioto, tiene opciones de acceso a un monto de 10 millones de dólares, que puede gestionar, ya sea por la vía de una institución implementadora internacional o a través de una institución nacional acreditada.

Para iniciar la elaboración de un proyecto de adaptación y gestionar el apoyo financiero al amparo del referido fondo, en julio - 2012, se realiza un taller de consulta al Comité Nacional de Cambio Climático de Panamá, para definir el área temática y geográfica del proyecto. Como resultado, se determina que el proyecto deberá enfocarse al desarrollo de actividades de adaptación relacionadas a los suelos y recursos hídricos, en el arco seco del país y el sector pacífico de la cuenca del canal de Panamá.

En este marco, se programaron y ejecutaron diferentes talleres de consulta a instituciones públicas, ONGs y productores del área seleccionada: Los Santos, Herrera, Coclé y Veraguas. Las consultas dentro de la cuenca del canal, la liderará la ACP. También se contemplan dos talleres adicionales de consulta e identificación de experiencias exitosas con instituciones nacionales e internacionales y ONGs, para considerarlas como insumo en la elaboración del proyecto.

2. Metodología de los Talleres

Estos talleres se realizaron en dos días, uno por cada provincia, con un total de tres sesiones de trabajo por día; el primero en la mañana, el segundo en la tarde y el tercero en la noche. En cada sesión se contó con la participación de un determinado grupo, según sus características (ONG, instituciones públicas y productores), para facilitar las discusiones y hacer más eficiente el proceso con cada grupo. El objetivo de esta estrategia, fue el de propiciar un manejo más eficaz en las sesiones, al dirigir las discusiones con grupos más

homogéneos en lo referente a su visión del problema, en el contexto de sus intereses y responsabilidades.

En cada sesión se realizó una presentación con diapositivas, sobre el tema de adaptación y se brindó una explicación detallada sobre el objetivo y metodología del taller. Luego los participantes se agruparon en mesas de trabajo (designando su respectivo moderador y relator), para las discusiones sobre las experiencias, proyectos, alternativas y recomendaciones que cada una considerara pertinente para proponer como insumo para la elaboración del proyecto de adaptación. Al final, cada mesa presentó en plenaria el resumen de sus discusiones y se abrió con espacio para las opiniones de la plenaria. En anexo, se adjunta la agenda de los talleres y lasrespectivas listas de asistencia.

3. Desarrollo de los talleres

Talleres en la Provincia de Herrera

Estos se realizaron el día 25 de septiembre de 2012, en las oficinas de la Asociación Nacional de Ganaderos de Herrera, localizadas en la Arena de Chitré. Cabe subrayar, que en cada sesión los participantes mostraron gran interés en el tema y en las sesiones de discusión fue muy notorio la expresión entusiasta y animosidad de los participantes.

- **Grupo de ONGs**

En la mañana se realizó el taller con las organizaciones no gubernamentales del área, con una asistencia de 8 representantes de 8 ONGs, de los cuales 7 eran hombres y 1 mujer. En el cuadro siguiente, se presentan, sin edición, las recomendaciones del referido grupo, incluyendo en el mismo todas las mesas.

Grupo de ONGs

Problema	Ideas de proyectos/qué hacer	Cómo hacerlo
Suministro y disponibilidad de agua para las principales actividades de la región (cantidad, calidad y permanencia) - Tomando en cuenta que este recurso es fundamental en la región.	Realizar un estudio de volumen y calidad del agua para el sustento en el Río La Villa	• Reforestación de cuencas altas, medias y baja con especies nativas. • Cosecha de agua a través de represas. • Promover tomas de agua. • Fomentar el reciclaje para evitar la contaminación de las fuentes de agua. • Capacitación a los grupos para la producción de abono orgánico. • Mejoramiento de los

		suelos.

- **Grupo de Instituciones Públicas**

En la tarde se realizó el taller con las instituciones públicas, con una asistencia de 20 representantes de 7 instituciones; de los cuales 15 fueron hombres y 5 mujeres. En el cuadro siguiente, se detallan,sin edición, las recomendaciones de este grupo, en el que incluyen todas las mesas.

Grupo de Instituciones Públicas

Problema	**Ideas de proyectos/qué hacer**	**Cómo hacerlo**
Manejo inadecuado de los recursos hídricos	Cultivo de agua de lluvia	• Construcción y mantenimiento de embalses de agua lluvia. • Programa de capacitación
Deforestación	Programa de reforestación con especies nativas (cítricos)	• Siembras planificadas.
Mal uso del suelo	Implementar rubros adaptativos al tipo de suelo	• Planificación de fincasen base a las características del suelo
Escasez de agua y malos sistemas de regadío	Cosecha de agua de lluvia Rotación de cultivos	• Implementar sistemas de reforestación y conservación del suelo.
Disponibilidad de agua	Cosecha de agua Extracción de fuentes de agua a través de energía alternas (solar,eólica)	
Seguridad alimentaria	Establecer módulos productivos familiares.	• Identificar a los beneficiarios
Degradación de los suelos y condiciones climáticas ambientales	Establecimiento de programa silvopastoriles (conservación de suelos, cercas eléctricas, pastos mejorados y especies proteínas) Establecer fincas agro turísticas (siembra de plantas y cría de animales nativos)	
Falta de lugares recreativos medio ambientales		

Desorden en la producción de cultivos	Establecer un programa de zonificación de los suelos	
Contaminación del medio ambiente	Establecer programas para la minimización en el uso de agroquímicos	

- **Grupo de Productores**

Los productores agropecuarios, participaron en la sesión de la noche. En total asistieron unos 19 productores tanto agrícolas como pecuarios, de los cuales todos eran hombres. A continuación se presenta, sin edición, el cuadro con las recomendaciones de este grupo, en el que se incluyen a todas las mesas.

Grupo de Productores

Problema	**Ideas de proyectos/qué hacer**	**Cómo hacerlo**
Escasez de agua en verano	Almacenamiento de agua	• Dragado del río • Recolección de agua lluvia • Represa • Limpieza de pozos
Falta de pastura adecuada	Sistemas silvopastoriles	• Estudios de suelo • Clasificación de semillas adecuadas.
Deforestación	Establecimiento de semilleros de árboles frutales y maderables	• Reforestación en cercas vivas a orillas de ríos y quebradas.
Falta de tecnología asistencia	Establecimiento de una política de desarrollo tecnológico.	• Convenios y alianzas estratégicas con diversas universidades estatales y privadas.
Falta de conocimiento y concienciación del factor humano	Proyectos del estadoy empresa privada	• Divulgación y creación de fondos
Escasez de agua	• Proyectos de represa • Reforestación	
Bajo rendimiento de producción	Proyectos de abono orgánico y mejora de semillas	
Sequia de afluentes	• Reciclaje de agua • Tratamiento de desechos. • Biodigestores.	
Mejoramiento de suelos	Siembra de leguminosas	
Remplazo de la gasolina	Fomento de la energía solar (planta de bombeo y paneles solares)	

Problemas de pastos	Incremento de sistemas silvopastoriles	
Aguas desprovista de vegetación	Implementación de sistemas agroforestales (maderables y frutales)	
Sedimentación de la cuenca de los ríos	Minirepresas escalonadas	
Escasez de agua en fincas	Cosecha de agua lluvia	• Represas, lagos, abrevaderos
Estrés calórico	Sistemas silvopastoriles	• Reforestación con especies que permitan crecimiento de los pastos
Falta de concientización de los problemas climáticos	Jornada de capacitación por el Estado y asociaciones	
Escasez de agua	• Cosecha deagua (minirepresas) • Reforestación	
Baja producción agropecuaria	Uso de semillas mejoradas	• Rotación de cultivos
Falta de energía alterna	Implementación de paneles solares	

Talleres en la provincia de Los Santos

Estos se realizaron el día 26 de septiembre de 2012, en las oficinas Regionales del Ministerio de Desarrollo Agropecuario, localizadas en Las Tablas. Al igual que para el caso de Herrera, que en cada sesión los participantes mostraron gran interés en el tema y en las sesiones de discusión fue muy notorio la expresión entusiasta y animosidad de los participantes. En este taller se contó con la asistencia del Gobernador de la provincia, quien manifestó su apoyo y gran interés y expectativa por este proyecto.

- **Grupo de Instituciones Públicas**

Con este grupo se trabajó en la mañana, de 26 de septiembre, con una asistencia de 21 representantes de 12 instituciones; de los cuales 17 eran hombres y 4 mujeres. En el cuadro siguiente, se detallan las recomendaciones de este grupo, integrando en el mismo, sin edición, las recomendaciones de todas las mesas.

Grupo de Instituciones Públicas

Problema	Ideas de proyectos/qué hacer	Cómo hacerlo
Pérdida de fertilidad de suelos	• Elaboración de abonos orgánicos a base de los	Creación de micro plantas de producción y

	desechos de fincas pecuarias • Micro plantas de producción • Plantas de reciclajes • Educación por medio de programas de reforestación escolar	transformación. Crear fondos. Llevar estos programas a nivel medio y pre-medio escolar.
Reducción de áreas de suelos para producción agropecuaria (agricultura y ganadería)	Mejoramiento de la calidad de los suelos para producción agropecuaria.	• Rotación de cultivos. • Uso de abono orgánico producto del aprovechamiento de los desechos agrícolas, ganadería (porcino y otros) y domésticos (incluyendo los lodos PTAR). • Maximizar o potenciar el uso de las áreas existentes de cultivo y ganadería.
Disminución de la disponibilidad de recursos hídricos para diversos usos	• Captación de agua lluvia. • Manejo integral de cuencas hidrográficas. • Campaña de sensibilización de uso adecuado del agua.	• Canalización, conducción y almacenamiento en tanques o embalses. • Reforestación de los bosques de galería. • Implementación de fincas sostenibles. • Tratamiento de aguas residuales que se viertan en los cuerpos de agua superficiales. • Incentivos, capacitación, etc.
Falta de recurso hídrico	• Cosecha de agua. • Explotación de agua subterránea	• Promover reservas comunales e individuales (lagos y mini presas). • Dragado de ríos.
Aumento de la vulnerabilidad en las zonas costeras	• Identificar las zonas vulnerables en la provincia. • Plan integral de gestión de riesgo. • Promover la conservación de los manglares.	• Estudios de líneas de base/análisis de la vulnerabilidad. • Fortalecimiento de las capacidades locales.

Falta de bosques en las orillas del río	• Plan de reforestación integral con especies nativas. • Creación de incentivos o bonos de reforestación a los propietarios.	• Concienciar y coordinar con los propietarios y autoridades locales. • A través de instrumentos canjeables en el mercado local. • Promoción de viveros comunales con apoyo de instituciones gubernamentales
Pérdida del suelo por alta erosión, incremento de la acidez y poca o nula materia orgánica	• Promover la conservación del suelo. • Minimizar la acidez de los suelos	• Recomendar a los productores otras técnicas de cultivos. Eje: curvas a nivel, uso de residuos, barreras vivas, barreras muertas. • Uso de abonos verdes, uso de rocas fosfóricas, abonos orgánicos, uso de cal -------?

- **Grupo de ONGs**

Este grupo participó en la sesión de la tarde del 26 de septiembre, con una asistencia de 12 representantes de 8 organizaciones, de los cuales 6 eran hombres y 6 mujeres. En el cuadro siguiente, se presentan, sin edición, las recomendaciones de todas las mesas de trabajo de dicho grupo, en el que se incluyen todas las mesas.

Grupo de Organizaciones No Gubernamentales

Problema	**Ideas de proyectos/qué hacer**	**Cómo hacerlo**
Sequía	Establecimiento de proyectos agroforestales sostenibles	Capacitaciones a grupos organizados (seminarios, talleres)
Escasez de agua (quebradas, ríos, etc.). Bajo rendimiento en las cosechas. Poco pasto para el ganado	Incorporar modelos silvopastoriles en fincas ganaderas. Incorporar iniciativas para generar agua en la finca.	• Asistencia técnica al proyecto (personal idóneo). • Incorporar modelos agroforestales que se adapten a la región y que sus productos se puedan comercializar. • Capacitación. • Asistencia técnica. • Establecimiento de pastos mejorados más

		leucaena. • Siembra de árboles maderables dispersos. • Enriquecer las quebradas y ríos con árboles del sitio. • Buscar asesoría técnica o entidades expertas en el tema (banco de agua, paneles solares, molinos de viento). • Si hay energía eléctrica, establecer pozos profundos (turbinas).
Erosión del suelo	Sistemas agroforestales	• Siembra de rabo de gallo, (cardulovica sp), etc.
Escases de agua	Educar sobre el uso del agua. Reforestación de cuencas hidrográficas (especies nativas)	• Manejo integral de las cuencas hidrográficas. • Capacitación (programa de divulgación). • Integración de las cuencas hidrográficas (reforestación).
Mal manejo de la basura (generación de malos olores, quemas)	Reciclaje. Implementación de casas con materiales reutilizados. Manejo y cultura de la basura (educación ambiental). Centro de acopio, de recolección y venta de la basura.	• Reducir. • Reusar.
Escases de agua en época seca	Cosecha de agua lluvia (concienciación/gobernabilidad del agua)	• Campañas de difusión en la Región para promover esta alternativa
Contaminación de las aguas por efecto de las porquerizas	Manejo sostenible de las porquerizas a través de la P+L. Establecimiento de biodigestores.	• Difusión/Divulgación de fincas pilotos

	Aprovechamiento de abono orgánico.	
Ganadería extensiva	Sistemas agroforestales y silvopastoriles. Utilización de turbinas a través de la implementación de paneles solares	• Difusión/Divulgación de fincas pilotos.
Fumigación aérea descontrolada (C. aérea) química	Promover el fomento de abonos orgánicos.	

Este grupo, planteó algunas recomendaciones adicionales y complementarias, en materia de sistemas agroforestales y silvopastoriles, que se detallan en el cuadro siguiente:

Sistema/Modelo	Acciones
Sistemas Agroforestales • A largo plazo	• Reforestar con árboles maderables dispersos (caoba, cocobolo, cedro amargo, cedro espino. • Beneficios económicos para la finca a largo plazo 20 a 30 años
• A mediano plazo	• Siembre de arboles frutales (guanábana, guayaba, cítricos, mangos, papaya, chirimoya, cocos).
• A Corto plazo	• Cultivo de productos agrícolas a corto plazo (plátanos en franjas, yuca, ñame, otoe, guandú, piña, maracuyá, granadilla, guabas). El guandú y las guabas como fijador de nitrógeno y alimento.
Modelos Silvopastoriles	• Establecimiento de modelos silvopastoriles (leucaena + pasto mejorado. • Banco de forrajes (Botón de oro, canabalia, caña de azúcar, sorgo forrajero, maicillo, maní forrajero, guácimo). • Siembra de árboles dispersos en la finca (guachapali, corotú, caoba). • Siembra en los perímetros de las fincas (cocobolo, cedro amargo).

OBS: todos los productos que salen de fincas contribuyen con M.O, fijadores de nitrógeno, fuentes de abono orgánico.

- **Grupo de Productores**

Los productores agropecuarios, participaron en la sesión de la noche. En total asistieron

unos 9 productores agropecuarios, de los cuales todos eran hombres. Para este grupo se conformaron dos mesas de trabajo. A continuación se presenta, sin edición, el cuadro con las recomendaciones de este grupo, en el que se incluyen las dos mesas.

Grupo de Productores

Problema	**Ideas de proyectos/qué hacer**	**Cómo hacerlo**
Falta de Agua	• Recuperación de las represas existentes • Perforación de pozos en forma ordenada	• Represas de mampostería o de tierra • Molinos de viento • Paneles solares • Consultar a personas idóneas en la materia y que conozcan el terreno donde se va a trabajar
Contaminación por desechos orgánicos productos de la actividad agropecuaria	Construir tinas de descontaminantes, para aprovechar lo desechos sólidos y líquidos	• Transformarlos en abonos orgánicos • Biodigestores • Plan piloto para promover energía renovable
Falta de conservación de cuencas y afluentes	Reforestar dichas áreas por bosques de galería	Incentivando al ganadero, por la cantidad de hectáreas reforestadas.
Falta de agua	• Proyecto de riego, corregimiento de Santa Ana • Represa de mampostería • Molino de viento y paneles solares	Agua del Río La Villa Represando fuentes de agua Pozos
Reforestación	Bosques de galería	Ríos, quebradas y lagos artificiales
Compra de CO_2	Conservación de bosques	Pagar a los productores

4. Trabajos grupales.

Trabajos grupales de lo las ONG's, provincia de Herrera – sesión matutina


Trabajos grupales de los grupos institucionales, provincia de Herrera – sesión vespertina

Trabajos grupales de los productores agropecuarios, provincia de Herrera- sesión nocturna

Trabajos grupales con las instituciones, provincia de Los Santos – sesión matutina

Trabajos grupales de las ONG's, provincia de Los Santos – sesión vespertina

DIRECCIÓN DE GESTION INTEGRADA DE CUENCAS HIDROGRAFICAS

UNIDAD DE CAMBIO CLIMÁTICO Y DESERTIFICACIÓN

INFORME DE TALLERES EN LAS PROVINCIAS DE COCLÉ Y VERAGUAS

Medidas de Adaptación, Para el Manejo Sostenible De la Tierra y Los Recursos Hídricos, En Zonas Degradadas en el Arco Seco y en la Cuencas Del Canal de Panamá.

Grupo Técnico

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Luis Delgado
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Lorena Vanegas
Valia Sousa

Preparado Por: Lorena Vanegas
Analista de Cambio Climático y Desertificación

Panamá 8 de Octubre de 2012

INFORME TÉCNICO

FONDO DE ADAPTACIÓN

PROYECTO
MEDIDAS DE ADPATACIÓN, PARA EL MANEJO SOSTENIBLE DE LA TIERRA Y LOS RECURSOS HÍDRICO, EN ZONAS DEGRADADAS EN EL ARCO SECO Y EN LA CUENCA DEL CANAL DE PANAMÁ

Objetivo General:

- Obtener información de ideas de proyectos en las provincias de Coclé y Veraguas de los grupos claves, ONGs,

productores e instituciones del sector estatal.

Objetivo Específico:

- Compilar información s de ideas de proyectos sostenibles y/u opciones tecnológicas, su aplicabilidad a la

adaptación al cambio climático en los sectores agua, agropecuario y salud.

Metodología:

- Definir Comunidades prioritarias para la aplicación de los proyectos de Coclé o Veraguas
- Con el apoyo de paleógrafos identificar las comunidades prioritarias y sus posibles proyectos propuestos con base en los talleres anteriores. Se utilizó la técnica denominada Diagnostico Rural Participativo (DRP).
- Formar grupos de trabajo para que se realicen propuestas de proyectos con enfoque de sostenibilidad y adaptación, que garantice un beneficios a la mayor población posible y logros de los objetivos para los cuales serán diseñados a los sectores ante identificado. Se estarán recibiendo toda documentación sobre las ideas de Proyectos.
- Realizar una valoración de los proyectos para definir los principales.
- Inducción del tema de adaptación

Actividad

- Se realizó la inducción en el tema de adaptación al cambio climático a los grupos claves con la finalidad de concienciar a las personas de la problemática ambiental específicamente en la temática de cambio climático. Una vez finalizado esta fase se organizó los grupos para armar el árbol del problema, con sus soluciones y comunidades beneficiadas.
- Se realizó la compilación de la información obtenida de los talleres de las provincias de Coclé y Veraguas.

Resultados

FONDO DE ADAPTACIÓN
PROYECTO
MEDIDAS DE ADPATACIÓN, PARA EL MANEJO SOSTENIBLE DE LA TIERRA Y LOS RECURSOS HÍDRICO, EN ZONAS DEGRADADAS EN EL ARCO SECO Y EN LA CUENCA DEL CANAL DE PANAMÁ

Taller Realizado el día 25 de Septiembre de 2012 en la Provincia de Coclé
Productores/ ONGs /Instituciones del Sector Estatal

Problema	Solución	Área
1. Contaminación (Fuentes de agua, atmósfera, salud comunitaria, recurso suelo).	Capacitación-Educación Ambiental Reciclaje Rellenos Sanitarios adecuados Participación social de las empresas, política normativa, leyes.	Provincia de Coclé
2. Falta uso de Energía Renovable -aumento del uso de combustible fósil.	Dar a conocer, promover, incentivar uso de biodigestores en escuelas.	Provincia de Coclé Escuelas que tengan producción de cerdos (Olá, La Pintada, Caimito, Rio Indio, Toabre, Llano grande).
3. Falta de técnicas Agroforestales Reducción de la producción Alteración del suelo	Aplicación de cero o mínima labranzas, rotación de cultivo y uso de abonos verdes con asistencia técnica. Practica y mejoramiento de la fertilidad de los suelo con prácticas económicas. Agrosilvopastoril.	Provincia de Coclé, Distrito de Penonomé, Antón y Natá (productores de arroz y maíz). Los Llanos de Coclé y corregimiento de Coclé, Coco y el Jobo.
4. Deterioro del Recurso Hídrico-Reducción de la producción.	Activación del sistema de riego de lajas. Manejo y establecimiento de viveros	Cuencas Prioritarias de la Provincia de Coclé • Río Chico de Natá • Río Zaratí • Río Grande • Coclé del Norte • Río Chico de Antón • Río Santa María
5. Perdida de la planta de bellota	Establecimiento de la planta de bellota	En las áreas norte de la Pintada, Membrillo, Llano Grande del distrito de la Pintada.
6. Incendios Forestales	Educación ambiental con énfasis en las escuelas	Cerro Guacamaya Bosque Siglo XXl Cerro Zuela India Dormida
7. Baja Producción	Capacitación Implementar proyectos agroforestales Uso de semillas mejoradas Asistencia técnica especificas	Provincia de Coclé

8. Falta de Conciencia Ambiental	Mayor Coordinación Interinstitucional ANAM, MUDUCA, SALUD y MIDA	Provincia de Coclé
9. Quema de Basura	Aumento de proyectos de Reciclajes Divulgación y producción de material referente a la quema de basura Crear un programa de capacitación en manejo de desechos	Provincia de Coclé
10.Falta de Servicio eléctrica	Proyectos de uso de energía renovables (paneles y aerogeneradores). Capacitación en energía renovables	Provincia de Coclé
10. Deforestación	Promoción de viveros escolares y/o escolares Promover la conservación de los bosques , divulgar Aplicar Agroforestería Capacitación en Manejo de Bosque	Provincia de Coclé
11. Contaminación de fuentes hídricas	Sensibilización en el manejo de cuencas hidrográficas. Repoblación y conservación de la cobertura basura de las Riviera de los ríos y ojos agua Adecuación de proyectos a P+l cercanos a las fuentes de agua.	Provincia de Coclé
12. Extracción de Arena	Capacitación a los gobiernos locales y la comunidad en el tema de extracción de arena y consecuencia	Provincia de Coclé
13. Deterioro de las partes Alta, Media y Baja de las Cuencas más importante de Coclé.	Proyecto de Reforestación en la parte Alta, Media y Baja de las Cuencas de importancia de la provincia.	Provincia de Coclé
14. Problemas en el abastecimiento de agua para la población en general. Particularmente en los acueductos de Comunidades Rurales.	Proyecto de Innovación de Tecnología para Productores y Ganaderos de la zona. Bomba de Mecate, Molinos de vientos, Paneles Solares	Provincia de Coclé
15. Uso de fertilizantes y agroquímicos, uso excesivo que en muchos caos va n directo a las fuentes de agua.	Proyecto de Monitoreo de Calidad de las Aguas (Calidad y Cantidad).	Provincia de Coclé
16. Degradación del suelo por el sobre pastoreo, y la deforestación, como también la practica	Proyecto de Conservación de suelo.	Provincia de Coclé

tradicional de Roza y quema.		
17. Perdida de los Bosques dendroenergetico	Proyecto de Reforestación Social, parcelas para uso de leña y estufas justas.	Provincia de Coclé
18. Las practicas tradicionales han llevado a la perdida de las àreas donde naturalmente existen estas especies.	Proyecto de flora (Orquideas y Plantas Medicinales), para comunidades aledañas a areas protegidas de la provincia.	Provincia de Coclé

FONDO DE ADAPTACIÓN
PROYECTO
MEDIDAS DE ADPATACIÓN, PARA EL MANEJO SOSTENIBLE DE LA TIERRA Y LOS RECURSOS HÍDRICO, EN ZONAS DEGRADADAS EN EL ARCO SECO Y EN LA CUENCA DEL CANAL DE PANAMÁ

Realizado el día 26 de Septiembre de 2012 en la Provincia de Veraguas
Productores/ ONGs /Instituciones del Sector Estatal

Problema	Solución	Área
1.Falta de Incentivo para Productores	Pagos por servicios ambientales Descuento de impuesto a colaboradores de la protección del ambiente Intereses preferenciales a buenas prácticas ambientales Patrocinio de insumos para productores que aplican técnicas amigables al ambientes	Provincia deVeraguas
2. Deforestación	Creación de vivero comunitarios Cumplimiento de las leyes Seguimiento y cumplimiento	Provincia de Veraguas
3. Falta de Agua	Conservación de las cuencas Reforestación Promover la Cosecha de agua de lluvia y utilización Regulación de la Perforación de pozos	Provincia de Veraguas
4. Carencia o bajos rendimientos en la producción	Dotación de semillas mejoradas y certificadas Análisis de Suelo Uso de abonos orgánicos Uso Racional de los abonos químicos Implementación de los sistemas de riego enfocada a P+L	Provincia de Veraguas
5.Falta de Cultura Ambiental	Inclusión de la materia ambiental en los planes de estudio escolares Divulgación masiva de los temas	Provincia de Veraguas

	ambientales por los medios de comunicación Charlas de divulgación en temas ambientales en escuelas y comunidades en general Promoción de actividades ambientales que involucren giras y días en general	
6. Degradación de los suelos	Implementación de sistemas de conservación Zonificación de áreas del cultivo Incorporación de materia orgánica Cultivo con cobertura Incorporación de sistemas agro-forestales	Provincia de Veraguas
7. Contaminación del agua y suelo	Promoción de los Sistemas de reciclaje Educación y seguimiento en el manejo de desechos orgánicos y reciclaje Diseño de programación orientado al manejo de los desechos orgánicos y no orgánico Programa orientado a sensibilización a las tomadores de decisiones de alto nivel Construcción de un centro de acopio de envases de agroquímicos	Provincia de Veraguas
8. No existe un verdadero ordenamiento territorial	Utilización del PIGOT Mapa de Capacidad agrológica de los suelos Clasificación de los recursos naturales	Provincia de Veraguas
9. Deterioro y Pérdida de los recursos costeros	Reforestación y recuperación de los manglares Sensibilización de las comunidades beneficiarias del manglares de su protección y conservación Fortalecimiento de la conservación de playas y zonas de anidamiento de las tortugas.	Provincia de Veraguas
10. Falta des sensibilización Ambiental	Incluir en los curriculum de formación formal las asignaciones ambientales. Promover grupos ambientales comunitarios	Provincia de Veraguas
11. Divulgación en los medios de comunicación	Promover el uso de abonos verdes Buenas Prácticas Agropecuarias	Provincia de Veraguas
12.Contaminación de Aguas residuales	Construcción de la planta de tratamiento de aguas residuales	Provincia de Veraguas
13.Contaminación por basura	Recolección, transporte y proceso de la basura	Provincia de Veraguas
14.Producción agropecuario	Promover la agricultura urbana y	Provincia de Veraguas

	rural	

FONDO DE ADAPTACIÓN
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Galería de Fotos

Taller del Fondo de Adaptación la Provincia de Coclé.

Taller de Adaptación en la Provincia de Coclé- Intervención de Productores del área.

Galería de Fotos
Técincos de ANAM, armando el árbol de problemas, soluciones y comunidad beneficiadasProvincia de Coclé.

Taller de Adaptación en Veraguas. Participaron productores, representantes de las ONGs e instituciones del sector estatal

LISTADO DE DOCUMENTACIÓN CONSULTADA PARA LA NOTA CONCEPTUAL

1- Material Guía del Fondo de Adaptación

- Instrucciones revisadas para la preparación de solicitudes de financiación de Proyectos/Programas (Revised Instructions for Preparing a Request for Project/Programme Funding)

- Procedimientos de Operaciones y aprobación (Approval and Operations Procedures)

- Criterios de Revisión de los Proyectos /Programas del Fondo de Adaptación (Adaptation Fund Project/Programme Review Criteria)

- Solicitud de financiamiento de Proyectos/Programas del Fondo de Adaptación (Request for Project/Programme Funding from Adaptation Fund) Lineamientos para Gestión por Resultados

- Lecciones Aprendidas del Proceso de Revisión de Proyectos del Fondo de Adaptación

2. Revisión de Proyectos/Programas aprobadas por el Fondo de Adaptación

- Propuesta de Ecuador. Enhancing resilience of communities to the adverse effects of climate change on food security, in Pichincha Province and the Jubones River basin - Project Document, Inception report, WFP 2011 Annual Report for Ecuador WFP. $7,449,468. 2011-03-18

- Propuesta de Nicaragua. Reduction of Risks and Vulnerability Based on Flooding and Droughts in the Estero Real River Watershed - Project Document, Inception Report. UNDP. $5,500,950. 2010-12-15
- Propuesta de Jamaica (Enhancing the Resilience of the Agricultural Sector and Coastal Areas to Protect Livelihoods and Improve Food Security - Project Document) $9,965,000- 2012-06-28
- Propuesta de Colombia (Reducing Risk and Vulnerability to Climate Change in the Region of La Depresion Momposina in Colombia - Project Document) –PNUD- $8,518,307- 2012-06-28
- Propuesta de Honduras. Addressing Climate Change Risks on Water Resources in Honduras: Increased Systemic Resilience and Reduced Vulnerability of the Urban Poor - Project Document, Honduras Inception Workshop Report final, Regional workshop findings on disaster risk reduction. PNUD. $5,620,300. 2010-09-17.

- Propuesta de El Salvador (con endoso a nivel de documento conceptual)

- Propuesta de Uruguay. Uruguay: Helping Small Farmers Adapt to Climate Change - Project Document, Project Cost Summary, Disbursement Schedule. ANII. $9,967,678. 2011-12-14

Informes de los Talleres de Consulta

- Informe de talleres en las provincias de Coclé y Veraguas. Compilado por: Lorena Vanegas, ANAM

- Informe de los talleres de Los Santos y Herrera. Compilado por: Lorena Vanegas, ANAM

- Matriz: ideas de proyectos para incluir en la propuesta del Fondo de Adaptación- ANAM

Propuestas institucionales remitidas a ANAM

- Propuesta de la Autoridad del Canal de Panamá para intervención en la Cuenca del Canal de Panamá- Propuesta completa enviada en el formato de aplicación del Fondo de Adaptación (en inglés).

- Propuesta de ANAM. "*Cosecha de Agua Lluvia para cuatro (4) Municipios del Arco Seco en la Provincia de Herrera".* Documento preparado por ANAM. Noviembre, 2012.

- Propuesta de ANAM. *Proyecto de Gobernanza del agua para establecer medidas de Adaptación al cambio climático en las zonas degradadas del Arco seco.*- Preparado por ANAM para potencial financiamiento del Fondo de Adaptación. 2012.

- Propuesta de ANAM. *Producción y reproducción de recursos didácticos para la Adaptación al Cambio Climático.*2012.

- Propuesta de CATIE. *Gestión de recursos financieros a nivel de organizaciones locales para la gestión integrada de recursos hídrico.* Propuesta enviada para consideración de ANAM, en el marco de la preparación de la propuesta para el Fondo de Adaptación.

- Propuesta de CATIE. Innovaciones tecnológicas para el mejoramiento de la rentabilidad, competitividad, y la adaptación al cambio climático en fincas ganaderas de la Península de Azuero. Propuesta desarrollada por el Programa GAMMA (Ganadería y Manejo del Medio Ambiente) del CATIE. Noviembre de 2012.

- Propuesta de ETESA. *Modernización y Expansión de la Red de Estaciones Hidrometeorologicas*. Documento preparado especialmente para ser considerado en las propuestas del Fondo de Adaptación. Preparado por Iván Jaramillo, Emanuel Aguilar. 12 diciembre de 2012.

- Propuesta del IDIAP**.** *Establecimiento del Banco de Semilla para la Conservación de Recursos Genéticos de Interés para el Consumo Local y de Exportación***.** Esta propuesta corresponde a un perfil de proyecto preparado para financiación de la SENACY. Preparado por Omar Alfaro, 2012.

- Propuesta del IDIAP. *Diseño e Implementación de estrategia de producción sostenibles en fincas ganaderos del sistema doble propósito en el Arco Seco de Panamá*. Documento desarrollado para ser considerado en la propuesta del Fondo de Adaptación. Noviembre, 2012.

- Propuesta de IDIAP. *Proyecto de Reforestación Ecológica e Investigación Forestal en Azuero*. Elaborado por Tomás Vázquez Ulloa. Septiembre de 2011.

- Propuesta de MIDA. *Instalación de Sistemas Fotovoltaicos para Bombeo de Agua en Fincas del Arco Seco.* Documento enviado en el formato de aplicación para el Fondo de Adaptación y acompañado por otro documento de perfil de proyecto para financiación del Fondo de Inversión Pública (preparado por Roddy Márquez).

- Propuesta del MIDA. *Programa de Difusión Tecnológica Ganadera*. Documento preparado utilizando el formato de la propuesta del Fondo de Adaptación. 2012.

- Propuesta del MIDA. *Ingeniería rural: optimización y racionalización del recurso hídrico en los sistemas de riego.* Documento preparado en el formato para el Fondo de Adaptación. 2012.

- Propuesta del MIDA. *Huerta Agroecológica Familiar. Programa Familias Unidas*. Preparado por Madga Bonilla e Iván Rodríguez.

- Propuesta del MIDA*. Fortalecimiento de la Gestión del Riesgo de Desastres en el Sector Agropecuario*. Enero de 2012.

- Propuesta de Fundación Natura. *Buenas prácticas de producción agrícola y forestal que permitan la conservación y protección de los bosques para enfrentar la escasez del agua y proteger los suelos.* Propuesta preparada para consideración de ANAM en la preparación de la propuesta al Fondo de Adaptación.

- Propuesta de la Fundación Natura. *Adaptación al cambio climático mediante el mejoramiento de los medios de vida, a través de la adopción de tecnologías que disminuyen el consumo de leña en la parte alta de las cuencas hidrográficas de los ríos La Villa y Santa María.* Propuesta preparada para consideración de ANAM en la preparación de la propuesta al Fondo de Adaptación.

- Propuesta de la Fundación Natura*. Fortalecimiento de capacidades a los gobiernos locales en el Arco Seco de Panamá para la adaptación al cambio climático.* Propuesta preparada para consideración de ANAM en la preparación de la propuesta al Fondo de Adaptación.

- Propuesta de la Fundación Natura*. Uso sostenible del recurso hídrico manteniendo y restableciendo las principales funciones ecológicas de las cuencas para asegurar la disponibilidad de sus servicios ambientales*

- *Propuesta de la UTP. Generación de un sistema de información para la reducción de vulnerabilidad a las inundaciones en el Arco Seco.* Documento preparado en el formato de aplicación del Fondo de Adaptación. 2012.