

## Impacts of climate change on biodiversity and summary of the required investment and financial flows (I&FF) for biodiversity in Costa Rica<sup>1</sup>

*Summary and interpretation by Irene Suárez, advisor on climate change policy and development*

Costa Rica chose to initially focus on water resources and biodiversity to dimension the investment and financial flows of adaptation options required to address the impacts of climate change in these two areas.

Biodiversity was chosen mainly because of the role it has in the provision of ecosystem services (which are essential for development and life itself) but also because it is an essential basis for tourism (the country's main revenue). It is also important to consider that Costa Rica covers 0.03% of global surface area has 4.5% of global biodiversity.

### 1. General aspects on biodiversity and climate change:

Mega-diverse Costa Rica has invested, over five decades, in different strategies of conservation of its biodiversity (strategies that were not designed to mitigate the negative impacts of climate change). However, the impacts of climate change upon biodiversity are significant and in many cases irreversible. To further understand these impacts, the country undertakes efforts in monitoring the impacts of climate change upon biodiversity which are included in the Second National Communication (see excerpt in Table 1).

Table 1. Recent evidences of climate change in Costa Rica

Zone	Observation	Relation to climate change
La Selva, Sarapiquí, Northern Region	33 populations of bird species have declined by 50%, by 30% in bats. Observations since 1970.	Drought associated with temperature rise, and pesticide use.
La Selva, Sarapiquí, Northern Region	75% of amphibians in the biological station had disappeared in the last 35 years.	Drought associated with high temperature provokes concentration changes in leaves, reproduction site for many amphibian species.
Monteverde, Puntarenas, North Pacific	The <i>Batrachochytrium dendrobatidis</i> fungus is the causative agent of death and disappearance of the golden toad and the harlequin frog. Two thirds of the frog population perished between 1980-1990	Climate change leads to more humid environments and warmer nights, which triggers the fungus.
Las Baulas Marine Park, North and Central Pacific	Alterations in nesting of sea turtles (Loras, Leatherback and Carey). In 1990, between 246 to 1000 Leatherbacks were expected. In 2005-2006 only 58 nested. Carey turtle nests were unusually found in the Central Pacific. In 20 years, the number of Lora turtles arriving to nest at Ostional increased twenty times.	High sea temperature and effects of El Niño affect the metabolism and ability to travel of sea turtles. Salinity and temperature can affect their migration routes.
Mangroves, whole country	The amazilia bird is a species endemic to Costa Rica that inhabits in mangroves. It is one of the 1226 species in critical risk of extinction. Declared endangered in 2007.	High temperatures and drought affect water surfaces and thus the bird's habitat.

<sup>1</sup> This paper was prepared by Irene Suárez for the UNFCCC technical workshop on costs and benefits on adaptation options under the Nairobi Work Programme on impacts, vulnerability and adaptation to climate change based on 2<sup>nd</sup> national Communication and literal results of the Investment and Financial Flow assessment created for the Government of Costa Rica with support of UNDP by the consortium of FUNDECOR and GFA Consulting Group in 2010.

Corcovado National Park, South Pacific	Of the 220 000 primates living in 1995, today only 107 000 remain. 1,000 primates perished in 2006, during a storm that hit the Osa Peninsula.	Increase of more intense extreme events. Disappearance of species from climate stress.
Caño Negro Wetland, Northern Region; and Sierpe, Central Pacific	Gender reversal in species has been observed, which may be linked to rising temperatures. It has been observed a reversal in the proportion of women who may be linked to increased environmental temperatures. Records from 1984-2005 at Caño Negro reveal an increase in the population of males during warmer years linked to El Niño. Increase in nest temperatures registered in 2005.	Increase in temperature linked to temperature increase in nests and birth of more males. Drought and El Niño affect species gender.

Source: 2<sup>nd</sup> national communication, 2009, National Meteorological Institute

The increased pressures on natural resources and the effects of climate change require a renewed vision of the management of natural resources and conservation strategies in the country. Nevertheless, current conservation strategies (i.e. currently there are 166 protected areas covering 26% of terrestrial surface and 17% of territorial marine area) are an important basis of adaptation options in this sector and the national communications and investment and financial flow assessment facilitate national discussions on this important matter.

## 2. Adaptation options for biodiversity and its required investment and financial flows (I&FF)

To undertake the assessment of biodiversity five priority areas were selected in the country:

- Land ecosystems
- Sea-coastal ecosystems
- Continental water ecosystems
- Knowledge generation
- Forest fires

A sample of preliminary adaptation measures for these priority areas of biodiversity include:

- Strengthen of the protected areas system (land and water)
- Increase control of land-use change and illegal tree felling
- Conservation and restoration of ecosystems
- Species protection and addressing invasive species
- Monitor of climate change effects and biodiversity
- Improve fire protection systems
- Strengthen education programmes

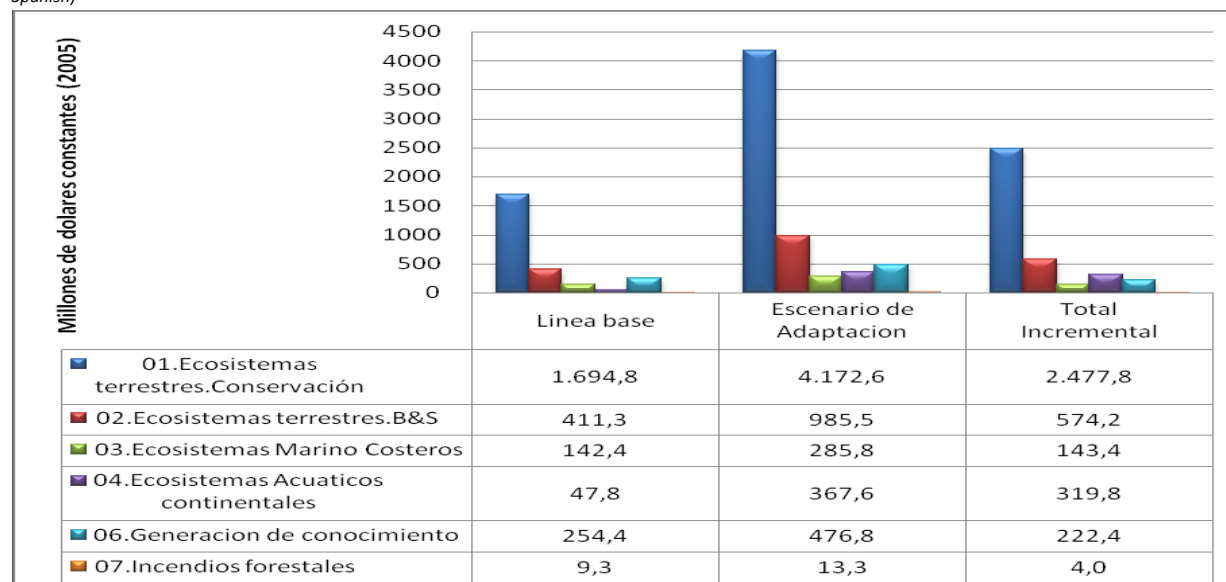
The priority areas of this sector and defining preliminary adaptation options was part of establishing key parameters of the I&FF assessment. The methodology used in Costa Rica was prepared by UNDP and covers nine phases:

- Establish key parameters of the assessment
  - i. Sector scope (subsectors)
  - ii. Identify key adaptation measures
- Compile historical I&FF and other data to project scenarios
- Define Baseline Scenario
- Derive I&FF for Baseline Scenario
- Define Adaptation Scenario
- Derive I&FF for Adaptation Scenario
- Subtract flows to estimate changes in I&FF needed to implement adaptation options
- Evaluate policy implications
- Synthesize results in report

## Key results and limitations

The investment and financial flow required for the identified adaptation options for biodiversity (per identified priority area) is a total of US\$ 3,918.2 million dollars (in a 2010 to 2030 time period). These key results are summarized in figure 1 following the current financial resources and the scenario including the adaptation option costs.

Figure 1. Investment and financial flows (in millions of US\$) considering Base Line, Adaptation Scenario and Total (and addendum table with translation of figure in Spanish)



Sectors/Required financial resources (US Dollars, millions)	i. Base line	ii. Adaptation scenario	iii. Incremental costs
01. Terrestrial ecosystems/ Conservation	1,694.8	4172.6	2477.8
02. Terrestrial ecosystems/ goods and services	411.3	985.5	574.2
03. Coastal marine ecosystems	142.4	285.8	143.4
04. Freshwater ecosystems	47.8	367.6	319.8
06. Knowledge management	254.4	476.8	222.4
07. Forest fires	9.3	13.3	4.0

The national communications and particularly the I&FF assessment processes have been very useful to provide a required dimension of the adaptation options: the financial requirements over a period of time to address climate change. This is already an important input for decision making. However, there are some limitations that must be registered:

- Some of the adaptation options were being implemented without thorough analysis of climate change impacts and although these options contribute to reduce vulnerability, these further analysis could ensure their contribution as an effective adaptation option (i.e. ensure that institutional strengthening undertaken considers requirements of climate change).
- The impacts of climate change on biodiversity produces multiplier effects on ecosystems and the services these provide. The service of vulnerability reduction that ecosystems services provide was not considered in this assessment.
- The experience of the program of payment of ecosystem services has strengthened the awareness of the benefits in conservation of biodiversity. There is a need of further information regarding the benefits of undertaking adaptation options to reduce the impacts of climate change on biodiversity and there is a need to understand the possible costs if there were no action undertaken.