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**Ad Hoc Working Group on Long-term Cooperative Action under the Convention**
**Fourteenth session**
**Bangkok, 5–8 April 2011, and Bonn, 6–17 June 2011***

Item 11 of the provisional agenda
**Market-based and non-market-based mechanisms**

# Views on the evaluation of various approaches in enhancing the cost-effectiveness of, and promoting, mitigation actions

## Submissions from Parties

## Addendum

1. In addition to the six submissions contained in document FCCC/AWGLCA/2011/MISC.4, one further submission has been received. This submission was originally included in FCCC/AWGLCA/2011/MISC.2.

2. In accordance with the procedure for miscellaneous documents, this submission is attached and reproduced** in the language in which it was received and without formal editing.

* The second part of the fourteenth session of the Ad Hoc Working Group on Long-term Cooperative Action under the Convention will be held in conjunction with the second part of the sixteenth session of the Ad Hoc Working Group on Further Commitments for Annex I Parties under the Kyoto Protocol and the thirty-fourth sessions of the Subsidiary Body for Implementation and the Subsidiary Body for Scientific and Technological Advice. The exact dates of the resumed sessions of the ad hoc working groups will be announced in due course.

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Submission from Ecuador

**The Yasuni-ITT Initiative: enhancing cost-effectiveness of, and promoting, mitigation actions**
**Document for UNFCCC**

**February 2011**


## Abstract

The Yasuni-ITT Initiative, based on the commitment from Ecuador to keep indefinitely large oil reserves underground in a sensitive Park within the Amazon rainforest, expands the notion of mitigation from avoided emissions to include unexploited fossil fuel reserves in environmentally sensitive areas in developing countries. This paper summarizes the direct and indirect contribution to mitigation from the Yasuni-ITT Initiative, explains its potential international replicability, and presents initial cost-effectiveness comparative estimates.

The Yasuni-ITT Initiative will contribute to avoiding 407 million tones of $CO_2$ emissions by keeping oil reserves unexploited. Additionally, taking into account investments of the UN administrated Yasuni Trust Fund on national-scale avoided deforestation, reforestation and renewable energy, total expected mitigation increases to more than a billion tones during a 30 year period.

Given the large scale of the reductions and other factors, the cost-effectiveness of the Yasuni-ITT Initiative is several times better than other conventional mitigation tools, based only on avoided deforestation.


## Background

Ecuador has one of the most diverse natural and cultural endowments in the word. The country has the highest amount of vertebrates per square kilometre on earth and is the second most diverse country of the world on the basis of endemic species per square kilometre. Additionally, Ecuador ranks among the top ten most abundant countries in absolute number of amphibians, birds and butterflies. Ecuador has also a rich cultural diversity, with 12 different indigenous cultures and 13 spoken languages (Josse, 2001).

In 1972 Ecuador became an oil exporter. Since then oil has been the centerpiece of the national economy, accounting for 57% of the country's total exports (2004-2010). Oil export revenues account to an average of 26% of the State revenue during the 2000 - 2009 period. This dependence on oil has, however, brought about serious economic, social and environmental difficulties (Larrea, 2006, Banco Central del Ecuador, 2011).

Large petroleum reserves have been recently confirmed in the ITT field, located within the Yasuni National Park in Ecuador, one of the most biodiverse hotspots in earth, and home of two isolated indigenous cultures (Larrea et.al. 2010, Bass, Finer, Jenkins, et al. 2010). The Yasuni-ITT Initiative was presented by President Correa at the UN Assembly in September 2007. In August 2010 Ecuador and UNDP signed an international agreement to constitute the Yasuni Trust Fund, under UNDP administration. Ecuador commits itself to keep indefinitely the ITT oil reserves unexploited, if an international contribution of at least 3.600 million dollars will be raised in 13 years, and UNDP will administrate the fund, assuring the transparency and effectiveness of the investments, which will be allocated exclusively on renewable energy facilities, energy efficiency in consumption, avoided deforestation, reforestation, social development, and research.

This paper summarizes the traits of the Yasuni-ITT Initiative proposed by Ecuador, explains its direct and indirect contribution as a mitigation program, and presents an initial evaluation of its cost-effectiveness.

**The Yasuni-ITT Initiative**

Large deposits of heavy crude petroleum have been recently confirmed in the ITT (Ishpingo-Tambococha-Tiputini) field, located in the Yasuni National Park, one of the most important and diverse biological reserves in the world (Bass, Finer, Jenkins, et al., 2010). According to the Trust Fund Agreement between the Government of Ecuador and UNDP (Gobierno Nacional de la República del Ecuador-UNDP, 2010), the Government of Ecuador commits to maintain the crude petroleum in the ITT field indefinitely underground. The rationale of this decision responds to the government political priorities with regard to social and environmental values first, and willingness to explore alternatives to derive economic benefits. However, this decision is contingent upon cooperation from the international community with the government of Ecuador, by contributing at least half of the revenue that the State would receive by extracting the petroleum. By doing so, the State would initially assume up to half of the opportunity cost of keeping the petroleum in the ground.

This original initiative proposes:

a) **An innovative option for combating global warming,** by avoiding the production of fossil fuels in areas which are highly biologically and culturally sensitive in developing countries;

b) **Protecting the biodiversity of Ecuador and supporting the voluntary isolation of uncontacted indigenous cultures** living in the Yasuni Park (the Tagaeri and Taromenane);

c) **Social development, nature conservation and implementing the use of renewable energy sources,** as part of a strategy aimed at consolidating a new model of sustainable human development in the country.

**Ecuador commits to indefinitely refrain from extracting the 846 million barrels of petroleum reserves in the ITT field, which is located** within the Yasuni National Park. The international community helps by providing a financial contribution, creating a capital fund to be administered by UNDP, with the participation of the Ecuadorian government, Ecuadorian civil society and international contributors.

The fund's **capital will be invested** in **renewable energy** projects in Ecuador, which have been selected due to their potential to generate stable and safe returns. Those projects will take advantage of the country's vast hydroelectric, geothermal, wind and solar potential. The implementation of those projects will contribute directly to the National Development Plan goals for the country to overcome its current dependence on fossil fuels, which currently account for 47% of all power generation (2006).

The interest earned from this fund will be invested by the State for the following purposes, within the guidelines of the National Development Plan (SENPLADES, 2009):

1. **Effectively conserving and preventing deforestation in 43 protected areas,** totalling 4.8 million hectares, and appropriately administering five million hectares of remaining original ecosystems. The total area protected would amount to about 38% of Ecuador's territory, one of the highest percentages in the world. Properly conserving the Yasuni Park would also allow the Tagaeri and Taromenane communities to remain in voluntary isolation.

2. **Reforestation, afforestation, natural regeneration and appropriate management of one million hectares,** mostly among small landholders. In addition, a substantial reduction in the current rate of deforestation, one of the highest in South America.

3. **Increase national energy efficiency** and savings.

4. **Promote social development in the initiative's zones of influence**, with programs that include health, education, training, technical assistance and productive job creation in sustainable activities, such as ecotourism, agriculture and agro-forestry.

5. **Research and development in science and technology** for: a) the creation of goods and services based on bio-knowledge, b) sustainable development and integrated water-basin management, and c) a shift in the national energy matrix.

The Yasuni-ITT fund will promote the transition from the current development model, based on petroleum extraction, to a new strategy based on equality and sustainability.

**The Yasuni National Park**

The Yasuní National Park is regarded as one the most biodiverse places on earth. It was created in 1979 and declared a UNESCO World Biosphere Reserve in 1989. It encompasses an area of 928,000 ha. in the upper Napo basin in the western Amazon region. Its strategic position, close to the equator and the Andes, endows it with one-off climatic conditions in the Amazon region, with relatively uniform, high temperatures and humidity (Bass, Finer, Jenkins, et al. 2010).

Scientists agree on the Park's unique value due to its extraordinary biodiversity, state of conservation and cultural heritage. The reserve is home to an estimated 2,274 tree and bush species; 655 species have been counted in just one hectare. The numbers account to more than the total number of native tree species in the United States and Canada combined. The Park has 593 recorded bird species, making it one of the world's most diverse avian sites. There are also 80 bat, 150 amphibian and 121 reptile species, as well as 4,000 vascular plant species per million hectares. The number of insects is estimated to be 100,000 species per hectare, the highest on the planet. In all the species there is a high degree of endemism (Bass, Finer, Jenkins, et al. 2010).

The Park has the highest density of amphibian, mammal, bird and plant species in the Amazon region. Furthermore, the projected temperature rise in the park due to climate change will be comparatively moderate, which makes the area strategically important for the future conservation of species. The Park's unique characteristics can be explained by a number of factors: its stable climate, with high rainfall, and warm but regular temperatures in different seasons. The diversity of its soil types creates various ecosystems on firm and flood-prone land. It has been said that the territory was a refuge in the Pleistocene era, a geological period when glaciations drastically cooled the earth's climate, turning most of the Amazon region into grassland. Species grouped in a few places – "the Pleistocene refuges" – where jungle still flourished, such as Yasuní's upper Napo region, leading to a process of speciation or the differentiated evolution of new species. The Pleistocene began 2.6 million years ago and ended 12,000 years ago (Bass, Finer, Jenkins, et al. 2010, Larrea et. Al., 2010).

Yasuní National Park is also home to two indigenous groups that have voluntarily chosen to stay in isolation from Western culture: the Tagaeri and the Taromenane, both belonging to the Waorani ethnic culture.

The exceptional and unique richness of the park is currently threatened by the oil business, the accelerated deforestation of the Ecuadorian Amazon region, and the construction of roads.[1]

**The ITT Oil Reserves**

According to recent estimates[2] there are 846 million barrels of recoverable heavy crude oil, with an average density of 14.7° API, in the ITT block. The oil exploitation of this field would mean the daily production of approximately 107,000 barrels for 13 years, with the wells continuing in their declining phase for a further 12 years.

The first exploratory well in the ITT field was drilled in the 1948 by Shell and a second one was done by the State in 1970. During the 1990 and early 2000s, 2D seismic exploration was performed and 5 additional wells were drilled[3]. Based on this information, in 2004 the French firm Beicip Franlab presented an economic and technical evaluation of the ITT field.

Beicip Franlab reported 412 million barrels of proven reserves, 921 million barrels of probable reserves, and 1,530 million barrels of possible reserves, with estimated total recoverable reserves of 846 million barrels, with an annual capacity of 107.000 barrels per day during 13 years, followed by a declining 12-year period (Table 1). Later, the Ecuadorian National Hydrocarbons Directorate estimated total proven reserves in 945 million.[4]

Total reserves may be higher than reported given that 3D seismic prospecting has not been performed in the ITT field. However, the Yasuni-ITT initiative is based in the conservative Becip Franlab estimate of 846 million barrels of total recoverable reserves, at a stabilized extraction rate of 107,000 barrels per day, during the initial 13-year extraction period.

[1] Sources: Scientists Concerned for Yasuní National Park, letter to the President of Ecuador, November 25, 2004; Bass M, Finer M, Jenkins C, et al. (2010), *Global Conservation Significance of Ecuador's Yasuní National Park.* PLoS ONE, Volume 5, Issue 1, January 2010; Horn, Carina (2006) "The Birth of the Mighty Amazon" in *Scientific American*, May, p. 40-45.

[2] Beicip Franlab (2004) Update on the ITT study. Upstream economic evaluation. Final report.

[3] The exploratory wells are: Tiputini 1 (Shell, nov. 1948), MP Tiputini 1 (Ministerio de Minas y Petróleos, june 1970), Tambococha 1 (Petroecuador, may 1993), Ishpingo 1 (Petroecuador, dec. 1992), Ishpingo 2 (Petroecuador, March 1993), Ishpingo 3 (Petroecuador, March 2002) and Isphingo 4 (Petroecuador, November 2001).

[4] Ministerio de Energía y Minas. Planificación Económica Integral de Crudos Pesados, 2007.

**Table 1**

**ITT Oil Reserves**

| Field | Layer | Specific gravity (API °) | Reserves (million barrels) | | |
|---|---|---|---|---|---|
| | | | Proven | Probable | Possible |
| Ishpingo Sur | B.Tena M1 | 15.4 | 81 | 195 | 339 |
| | M2-U | 13.9 | 64 | 104 | 145 |
| Ishpingo Norte | B.Tena M1 | 14.8 | 39 | 93 | 164 |
| | M2-U | 14.0 | 44 | 68 | 86 |
| Tambococha-Tiputini | B.Tena M1 | 14.2 | 184 | 461 | 796 |
| | M2-U | 14.2 | 0 | 0 | 0 |
| Total | | | 412 | 921 | 1,530 |

Source: Petroamazonas, 2010[5].
Based on: Beicip-Franlab.

**Avoided $CO_2$ Emissions**

The direct carbon dioxide ($CO_2$) mitigation from the Yasuni-ITT Initiative refers to the benefit of keeping oil reserves underground, thus avoiding the emission of $CO_2$, which would be released into the atmosphere by burning the extracted oil.

To estimate the amount of direct avoided $CO_2$ emissions, the volume of total recoverable reserves (846 million barrels) has been transformed to mass units (tonnes), taking into account the specific gravity of the heavy oil (average of 14.7 API°, bur changing according to specific fields). Then, using the carbon concentration of the ITT oil, the total carbon mass has been estimated. Finally, the total $CO_2$ mass of potential emissions from burning the extracted reserves was estimated resulting in 407 million tonnes.

According to the Ecuador-UNDP international agreement, the total amount to be raised and administered by the Trust Fund is equivalent to the 407 million tones of avoided $CO_2$ emissions, valued according to the price at that date of each particular contribution of the European Union Allowances (EUAs) in the Leipzig Carbon Market.

The amount of direct $CO_2$ emissions that would be prevented in ITT is considerable: surpassing the annual emissions of Brazil (332 million tonnes) and France (373 million tonnes), and the equivalent of Ecuador's emissions (29 million) over 13 years[6].

[5] Petroamazonas. Prefactibilidad Desarrollo Campos Tiputini-Tambococha, Desarrollo Bloque 31, 2010
[6] UNDP (2008). Human Development Report. http://hdr.undp.org/en/reports/global/hdr2007-2008/.

Using the market value of the European Emission Allowances (EUA) on the recent European market, i.e. US$ 19.81 per tonne of $CO_2$-eq[7], the economic value of the emissions prevented by the Initiative would amount to US$ 8.067 billion[8.]

The Yasuní-ITT Initiative entails Ecuador making an internationally binding commitment to indefinitely keep the oil reserves of the ITT field underground, thus preventing the emission of 407 million tonnes of $CO_2$, which would be released by burning the extracted oil. The real value of the emissions prevented could be greater if one takes into account the effects of deforestation directly and indirectly associated with oil extraction, the emissions generated by oil exploitation and the construction of infrastructure, the methane produced by cattle in colonized areas, and other sources.

The revenues that the State would receive if the oil were to be extracted are currently valued at 7.25 billion U.S. dollars, based on the reference price of US$ 76.38 per WTI barrel at September 14, 2010[9].

**Promoting mitigation from avoided deforestation, reforestation and renewable energy**

The Fund capital will be invested exclusively on renewable energy projects (hydroelectric, wind, solar and geothermic), and the interest will be invested mostly on avoided deforestation, reforestation and energy consumption efficiency. In all this cases, additional emission reductions will be generated.

**Avoided Deforestation.** Ecuador is one of the countries with the highest proportion of undisturbed rainforests in its territory. According to ECLAC, in 2010, the figure was 35%. Moreover, Protected Areas account for 20% of national land. Map 1 presents the extension of non-intervened ecosystems in Ecuador in 1996. Most of remaining forests are located in the Amazon region. However, Ecuador is also affected by a very high deforestation rate (1.7% per year), the third highest in Latin America[10]. Deforestation has been largely the result of oil exploitation in the Amazon region.

Given the unique biodiversity of the country, its large remaining areas of rainforest, and the high deforestation rate, reducing deforestation is a national priority. It has been pointed out both in the 2008 Constitution and in the National Development Plan.

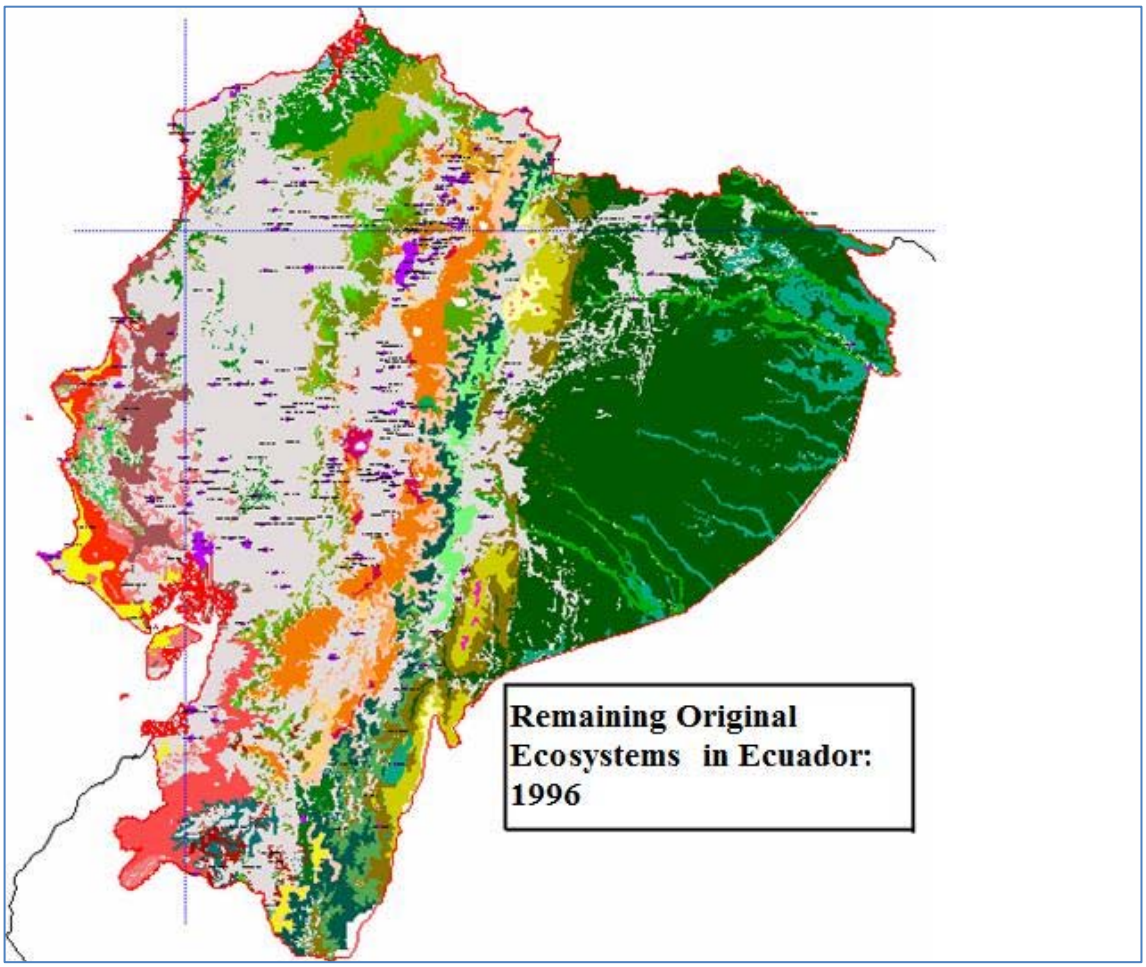
[7] September 14, 2010.

[8] If the emissions prevented are distributed over a 13-year period, their current net value would be US$ 5.37 billion, using a social discount rate of 6% per annum. Taking the latest EUA price, as of Febraury 18, 2011, of US$ 20.31 per tone, the present value is 5.51 billion dollars.

[9] Tanking current oil Price of US$ 86.40 (WTI) at February 18, 2011, the present value of oil is 8,614 million dollars. A social discount rate of 6% per annum was used.

[10] ECLAC, Statistical Yearbook of Latin America, 2010. (www.eclac.org)

**Map 1**



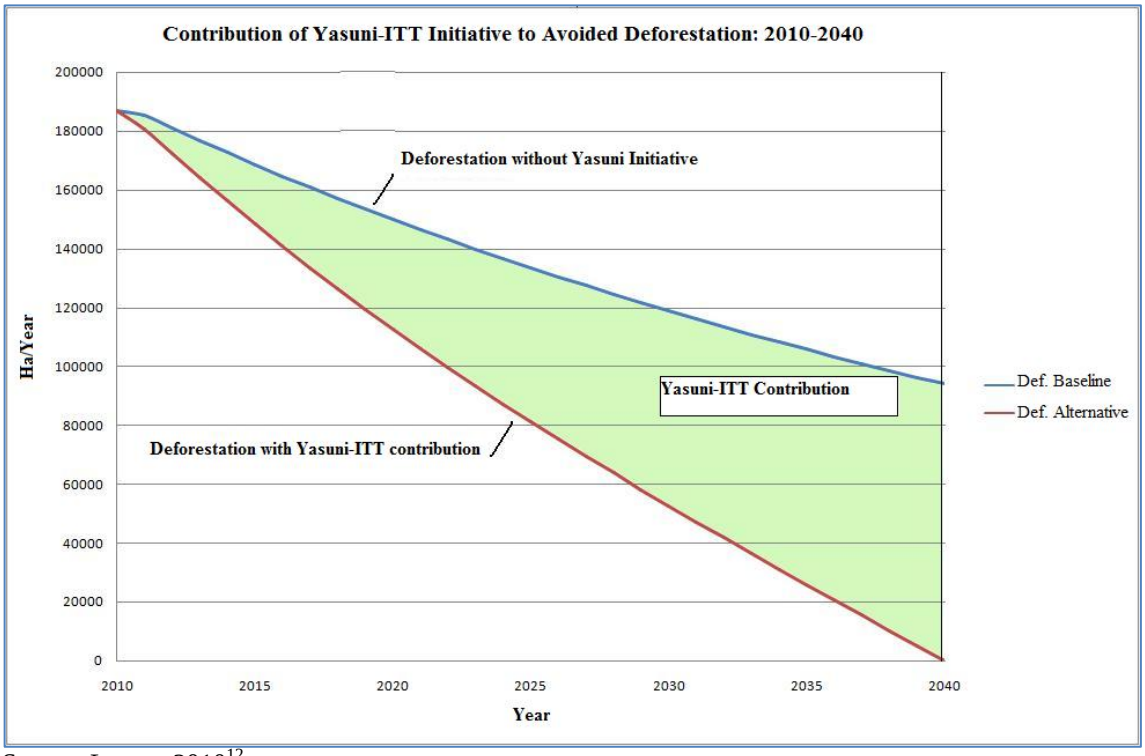

Source: Rodrigo Sierra (ed), 1999.

One of the most important goals of the Yasuni-ITT initiative is avoiding deforestation and effectively protecting undisturbed rainforest and remaining ecosystems in Ecuador. A significant part of the interests generated by the trust fund project portfolio of investments will be re-invested to achieve this goal, providing a stable financing support for a long term strategy.

The goal is to significantly hold deforestation in Ecuador, eliminating it in a 30 year period. Figure 1 depicts the contribution of the Yasuni-ITT Initiative to reducing deforestation. The total avoided deforested areas in 30 years reach 1.35 million hectares, with an avoided emission of 791 million tones of $CO_2$. This estimation is also consistent to a research from the Dutch firm Sylvestrum, which concludes that the potential mitigation contribution from the Yasuni-ITT Initiative regarding avoided deforestation and degradation reaches 820 million tonnes in a 20-year period[11].

[11] Silvestrum, (2009). "Analysis of the IYY-Yasuni Initiative vis-a-vis Carbon Markets". Unpublished document. The estimate was based on a detailed analysis of the remaining ecosystems in Ecuador, and the economic costs and benefits of reducing deforestation.

Figure **1**




Source: Larrea, 2010[12].

**Reforestation.** The interest window of the Trust Fund will finance the reforestation, afforestation and natural regeneration of one million hectares in Ecuador, over a 30-Year period. The program will benefit mostly small land holdings. The contribution to mitigation has been estimated to reach up to 68 million tones of $CO_2$.

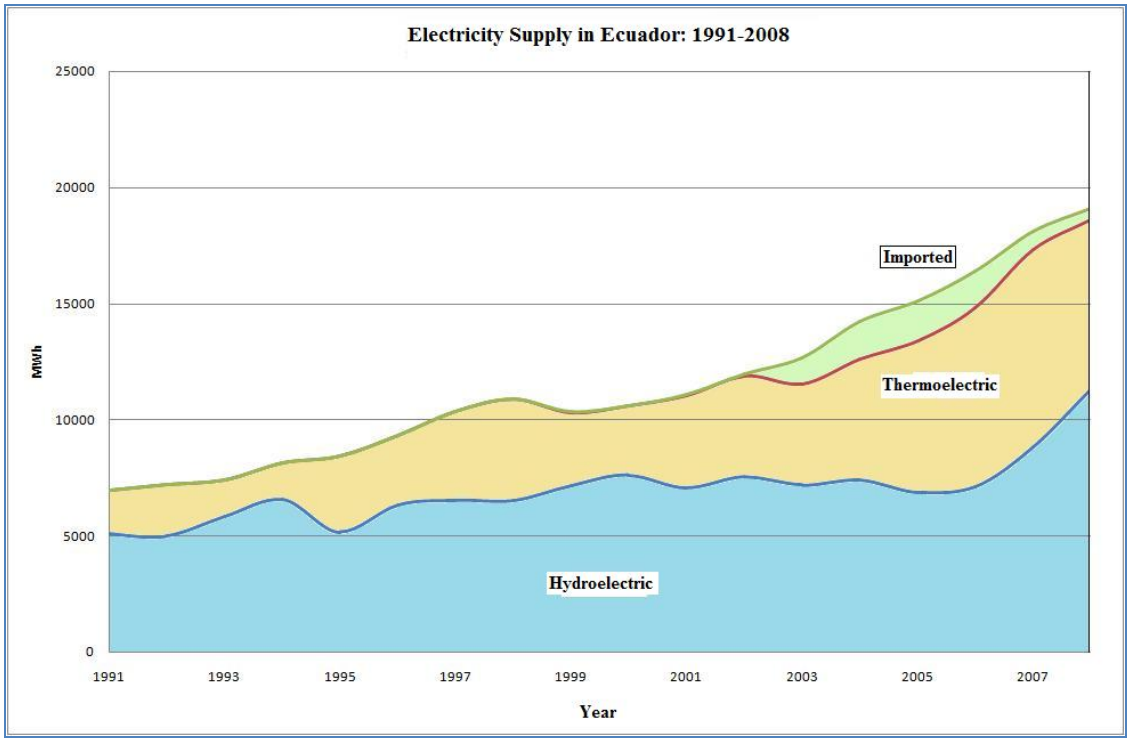
**Renewable energy generation.** The Yasuni Fund will be invested exclusively on renewable energy facilities in Ecuador (hydroelectric, solar, wind and geothermal). The country electric demand is growing at 6% per year and, given the weak investment between 1990 and 2006, fossil fuel generation accounted for 47% of the electricity supply in 2006. The current government fostered investment in hydroelectric projects, increasing the share of renewable sources to 59% in 2008, as shown in Figure 2.

Ecuador hydroelectric facilities tap only 10% of the country hydro potential capacity. Additionally, Ecuador has a very large untapped renewable energy resources The areas that have received attention include geothermal and solar energy and until recently wind energy. The Yasuni Fund will accelerate the total conversion of power supply to renewable sources. The contributuion of energy conversion to mitigation has been estimated to reduce 43 million tonnes of $CO_2$ emissions, form which al least 30% will be the direct result of the Initiative.

[12] Carlos Larrea, (2010) "Apoyo de la Iniciativa Yasuní-ITT a la Generación Eléctrica Renovable y a la Deforestación Evitada en el Ecuador". Quito: unpublished document.

In conclusion, the direct mitigation of 407 million tonnes from keeping the ITT reserves unexploited will be complemented with indirect mitigation of 791 million tones from avoided deforestation, 68 million tonnes from reforestation, and at least 12 million tonnes from building renewable energy facilities, over a 30 year period. The indirect mitigation add up to 871 million tones of $CO_2$, bringing the total mitigation to 1,207 million tonnes of $CO_2$, about three times higher than the direct mitigation.

**Figure 2**




Source: CONELEC, 2008.[13]

**Replicability of the Yasuni-ITT Initiative**

The Yasuni-ITT initiative is pioneering a mitigation activity from a developing country. It involves keeping fossil fuel reserves underground indefinitely in areas of high environmental and/or cultural fragility.

The replicability of the Initiative warrants the fullfilment of the following criteria:

1. Be developing countries. a critical factor of the Initiative is that it seeks to simultaneously achieve three aims: to combat climate change, maintain biodiversity, and reduce poverty and inequality in a developing country. The Initiative promotes sustainable development.

2. Be megadiverse countries. These countries hold most of the planet's biodiversity.

3. Have significant fossil fuel reserves in areas of high biological and cultural sensitivity.

[13] CONELEC (2008) *Plan Maestro de Electrificación 2009-2020*. (www.conelec.gov.ec).

Countries that meet all these criteria include Brazil, Colombia, Costa Rica, Democratic Republic of Congo, Ecuador, India, Indonesia, Madagascar, Malaysia, Papua New Guinea, Peru, Bolivia, the Philippines and Venezuela.

The United Nations Environment Programme (UNEP) has defined 17 countries in the world as "megadiverse".

**The cost-effectiveness of rhe Yasuni-ITT Initiative**

The previous sections have described how the Yasunit Initiative promotes mitigation actions. This section presents preliminary estimates of the level of cost-effectiveness of the Inititave for achieving, and promoting, mitigation. The cost estimates show that the Initiative is likely to enhance cost- effectiveness of mitigation actions.

Table 1 summarizes the total costs of the Yasuni Iniative. The costs considered for this preliminary analysis include net present values for expenditures faced by the goverment for the design, implemenation and evaluation/monitoring of the Initiative for a 30-year period. Design costs relate to expenses for information search, administration, and consultancy services for emissions base-line and opportunity costs estimation. Implementation envolves goverment expenses for initial operations including staffing and fund raising. Evaluation/monitoring accounts for administrative activities for the operation across the 30 year period.

**Table 1. Costs per CO2 – eq for land use-based mitigation actions in Ecuador**

| Type | | Activity | Emissions (in millions CO2-eq ton) | NPV - Discount rate (6%) | | NPV - Discount rate (12%) | |
|---|---|---|---|---|---|---|---|
| | | | | Costs (in million USD $) | Costs (in USD $ per CO2-eq ton) | Costs (in million USD $) | Costs (in USD $ per CO2-eq ton) |
| Yasuni-ITT | Program-based / avoidance | Oil extraction | 407,00 | 20,87 | 0,017 | 18,38 | 0,015 |
| | | Deforestation (Min) | 791,00 | | | | |
| | | Deforestation (Max) | 820,00 | 24,53 | 0,020 | 21,85 | 0,018 |
| Socio Bosque | Program-based / avoidance | Deforestation | 26,90 | 7,90 | 0,240 | 7,90 | 0,240 |
| PROFAFOR* | Project-based / sequestration (CDM-like) | Reforestation | 2,23 | 6,54 | 0,580 | 6,54 | 0,580 |

* present value for 1994-2005, comprises monitoring, certification, and promotion recurrent costs. Different from running costs reported by Wunder and Albán (2008) as costs of direct payments have been removed given that are not consider costs in the present study.

For sensitivity purposes, two cost scenarios have been identified. Previous research has showned that programs costs could follow altenative structures and distributuion of shares across types, and informed this analysis by providing information on costs structure for implementation of land use-based mitigation[14]

[14] Reducing greenhouse gas (GHG) emissions is the focus of domestic and international policies to lower the risks of anthropogenic climate change. A number of studies have now suggested that land-based carbon credits can reduce the costs of meeting stringent GHG goals by developed nations (e.g., Sohngen and Mendelsohn, 2003; Tavoni et al., 2007, Nabuurs et al, 2007; Kindermann et al., 2008). Many of the credits that these studies anticipate are derived from actions undertaken in developing countries. Land-based

activities in developing countries. The first scenarios follows a costs structure for an afforestation / reforestation activity consistent with the modalities and procedures of the Clean Development Mechanism (CDM) of the United Nations Convention on Climate Change (UNFCCC). This scenario accounts for a distribution of shares between launching costs and operational expenses, with 6% and 94% respectively. The second escenario follos a cost structure consistent with Reduced Emissions from Deforestation and Forest Degradation (REDD+) type of activities. In this context, launching costs add up to 12% of total costs and operational expenses are about 78%. Those two scenarios provides us with two conservative lower and upper bound for total costs.

As shown in Table 1, the Yasuni Initiative is likely to offer great advantages for enhancing cost-effectiveness, relative to other land use-based mitigation activites that have been implemented in Ecuador. For the first scenario, the net present value for total costs per $CO_2$-eq ton ranges from USD $ 0.017 to 0.015 considering a 6% and 12% discount rate. For the second scenario, total costs per $CO_2$-eq ton range from USD $ 0.020 to 0.018. In each case, total costs for unit of reduction of the Yasuni Initiative do not surpass a 10% of total costs in land use-based mitigation activities implemented in Ecuador.

Two characteristics seem to act in favor of this result. One is the likely diminishing behavior of costs relative to scale for each unit of reduction. The second seems to be relative experience that Ecuador has achieved for program implementation. As a matter of fact, the programmatic approach to mitigation actions seemed relatively advantegeous in itself to the project-based approach underlying current action under the CDM.

To extend this analysis, Table 2 presents different measures of costs for program design, implementation and evaluation/monitoring for land-based mitigation actions both in developed and developing countries. As in the previos comparison, the Yasuni Initiative seems to offer an alternative to enhance costs-effectiveness of mitigation actions in developing countries. This quantitative benefit increases the competitive advantage of the Yasuni Initiative on top of the benefits associated to the promotion of additional mitigation actions that will be deliver from investments in a portfolio of projects (i.e., reforestation and renewable energy) and social investments.

activities, therefore, offer a challenging benchmark for alternative approaches to enhance cost-effectiveness, and promote mitigation actions.

**Table 2 Summary of costs for land-based mitigation (modified from Olsen and Bishop 2009)**

| | Country / Region | TOTAL (in USD $ per $CO_2$ -eq ton) | Source |
|---|---|---|---|
| The Yasuni Initiative | Ecuador | 0,020 - 0,015 | |
| Socio Bosque (REDD-like) | Ecuador | 0,24 | Ortega-Pacheco et al. (2010) |
| PROFAFOR (Afforestation/Reforestation CDM-like) | Ecuador | 1,42 | Wunder and Alban (2008) |
| Forestry offset projects | Ecuador | 1,22 | Antinori and Sathaye (2007) |
| Forestry offset projects | Global | 0,38* | Antinori and Sathaye (2007) |
| Average aggregated costs | | 1** | Boucher (2008) |
| U.S. Conservation Reserve Program (CRP) | United States | 1** | Sohngen (2008) |

* average min 0.03 and max 1.23; ** This estimate is based on the aggregation of sub-sets of implementation and transaction costs from a range of studies: Antinori and Sathaye's (2007) average estimate, Nepstad et al.'s (2007) implementation cost estimate - including project and national level costs- and Grieg- Gran's (2006) highest administrative cost estimate - includes Costa Rica, Mexico, and Ecuador.

**References**


Albán M. y M. Argüello. 2004. *Un análisis de los impactos sociales y económicos de los proyectos de fijación de carbono en el Ecuador: El caso de PROFAFOR-Face. EcoCiencia*. IIED. Quito.

Antinori, C., and Sathaye, J. 2007. "Assessing transaction costs of project-based greenhouse gas emissions trading." LBNL-57315. Lawrence Berkeley National Laboratory. Berkeley, CA.

Banco Central del Ecuador, *Información Estadística Mensual*, Enero 2011.

Bass M, Finer M, Jenkins C, et al., *Global Conservation Significance of Ecuador's Yasuní National Park.* PloS ONE, Volume 5, Issue 1, January 2010.

Beicip Franlab, *Update on the ITT study. Upstream economic evaluation. Final report.* Quito: 2004, unpublished document.

Boucher, D. 2008. Out of the woods: A realistic role for tropical forests in curbing global warming. Union of Concerned Scientists, December 2008, Cambridge, MA.

CONELEC (2008) *Plan Maestro de Electrificación 2009-2020.* (www.conelec.gov.ec).

ECLAC, Statistical Yearbook of Latin America, 2010. (www.eclac.org)

Gobierno Nacional de la República del Ecuador- UNDP, *Memorandum of Agreement between the Government of Ecuador and the United Nations Development Programme for Management and Other Support Services Related to the Ecuador Yasuni ITT Trust Fund.* Quito, 2010.

Grieg-Gran, M. 2006. The cost of avoiding deforestation: Report prepared for the Stern Review of the Economics of Climate Change: IIED, London, UK.

Horn, Carina "The Birth of the Mighty Amazon" in *Scientific American*, May 2006, p. 40-45.

Josse, Carmen (ed.), *La Biodiversidad del Ecuador: Informe 2000*, Quito, MAE, EcoCiencia, UICN, 2001.

Kindermann, G., M. Obersteiner, B. Sohngen J. Sathaye, K. Andrasko, E. Rametsteiner, B. Schlamadinger, S. Wunder, R. Beach. 2008. "Global cost estimates of reducing carbon emissions through avoided deforestation." *Proceedings of the National Academy of Sciences*. 105(30), 10302–10307.

Larrea, Carlos, *Hacia una Historia Ecológica del Ecuador: Propuestas para el Debate.* Quito: Corporación Editora Nacional-Universidad Andina Simón Bolívar-Ecociencia, 2006.

Larrea, Carlos, "Apoyo de la Iniciativa Yasuní-ITT a la Generación Eléctrica Renovable y a la Deforestación Evitada en el Ecuador". Quito: unpublished document, 2010.

Larrea, Carlos et. al, *Yasuní-ITT: una iniciativa para cambiar la historia.* Quito: Gobierno del Ecuador, 2010.

Ministerio de Energía y Minas. *Planificación Económica Integral de Crudos Pesados*, Quito: unpublished document, 2007.

Nabuurs, G.J., O. Masera, K. Andrasko, P. Benitez-Ponce, R. Boer, M. Dutschke, E. Elsiddig, J. Ford-Robertson, P. Frumhoff, T. Karjalainen, O. Krankina, W.A. Kurz, M. Matsumoto, W. Oyhantcabal, N.H. Ravindranath, M.J.

Sanz Sanchez, X. Zhang, 2007: Forestry. In Climate Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [B. Metz, O.R. Davidson, P.R. Bosch, R. Dave, L.A. Meyer (eds)], Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Nepstad, D., Soares-Filho, B., Merry, F., Moutinho, P., Rodrigues, H.O., Bowman, S., Schwartzman, S., Almeida, O. and Rivero, S. 2007. The costs and benefits of reducing carbon emissions from deforestation and forest degradation in the Brazilian Amazon. Woods Hole Research Centre, Falmouth, MA, USA.

Olsen, N. and J. Bishop (2009). *The Financial Costs of REDD: Evidence from Brazil and Indonesia*. Gland, Switzerland: IUCN. 64pp.

Ortega-Pacheco, D. 2010. Investigating the role and scale of transactions costs of incentive-based programs for provision of environmental services in developing countries. Doctor in Philosophy Dissertation. The Ohio State University, Columbus, Ohio. 168 p.

Petroamazonas. Prefactibilidad Desarrollo Campos Tiputini-Tambococha, Desarrollo Bloque 31, Quito: unpublished document, 2010.

Scientists Concerned for Yasuní National Park, Letter to the President of Ecuador, November 25, 2004.

SENPLADES, *Plan Nacional para el Buen Vivir, 2009-2013.* Quito, SENPLADES, 2009.

Sierra, Rodrigo (ed.), *Propuesta Preliminar de un Sistema de Clasificación de la Vegetación para el Ecuador Continental*, Quito, EcoCiencia-GEF, 1999.

Silvestrum,. "Analysis of the IYY-Yasuni Initiative vis-a-vis Carbon Markets". Quito: Unpublished document. 2009.

Sohngen, B. and R. Mendelsohn. 2003. "An Optimal Control Model of Forest Carbon Sequestration" *American Journal of Agricultural Economics*. 85(2): 448-457.

Sohngen, B. and R. Mendelsohn. 2007. "A Sensitivity Analysis of Carbon Sequestration." Chapter 19 in Human-Induced Climate Change: An Interdisciplinary Assessment. Edited by M. Schlesinger, H.S. Kheshgi, J. Smith, F.C. de la Chesnaye, J.M. Reilly, T. Wilson, and C. Kolstad. Cambridge: Cambridge University Press.

Sohngen, B. 2008. Paying for Avoided Deforestation – Should We Do It? Choices, 1st Quarter 2008, 23(1).

Tavoni, M., B Sohngen, and V. Bosetti. 2007. " Forestry and the carbon market response to stabilize climate." *Energy Policy*. 35(11): 5346-5353.

UNDP, *Human Development Report*. New York: UNDP, 2008. http://hdr.undp.org/en/reports/global/hdr2007-2008/.

Wunde, S. and Alban, M. 2008. Decentralized payments for environmental services: The case of Pimampiro and PROFAFOR in Ecuador. *Ecological Economics* (65) 685-698.