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Ecuador's Yasuni-ITT Initiative: Avoiding emissions by keeping petroleum underground ☆

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ABSTRACT

As large petroleum reserves were confirmed in the Yasuni National Park of Ecuador, one of the most biodiverse hotspots in the Amazonian region and the world, Ecuador has proposed indefinitely keeping almost a billion barrels of petroleum underground, if the international community contributes with at least half of the opportunity cost of exploiting the petroleum. An internationally administrated fund with UN participation will be created and invested exclusively in conservation, renewable energy and social development. The proposal has already received significant support from international institutions, European governments, NGOs and personalities worldwide.

Ecuador, a less developed country in South America, remains dependent of petroleum exports, which have not led to economic growth and diversification, did not reduce poverty and inequality, and had strong environmental impacts. Given the limits of petroleum reserves, the Yasuni-ITT initiative opens alternatives towards sustainable development in the country, allowing a transition towards a post-petroleum society, and promoting ways towards human development within the limits of biodiversity conservation.

This proposal, which can be replicated by other developing countries with fossil fuel reserves in biodiverse areas, opens new alternatives for post-Kyoto negotiations with binding commitments for several developing countries, and simultaneously addresses global warming, biodiversity loss, and poverty. In addition, it addresses national and international environmental justice.

The article summarizes the proposal within the post-Kyoto context, and discusses relevant topics, such as its significance for Ecuador's development performance and future, as well as national and international environmental justice.

Introduction

Large petroleum reserves have been recently confirmed in the Yasuni National Park in Ecuador, one of the most biodiverse hotspots in earth, and home of two isolated indigenous cultures. President Correa of Ecuador proposed to the world to indefinitely keep petroleum reserves in the ground, if an international contribution reaches at least half of the opportunity cost of exploiting the petroleum. A trust fund, under international administration with UN participation, will be created for investments in conservation, renewable energy and social development. This innovative Yasuni-ITT Initiative simultaneously mitigates global warming, protects biodiversity and indigenous cultures, reduces poverty and enhances environmental justice. This article summarizes the initiative, and discusses it into the context of post-Kyoto negotiations, addressing also aspects such as environmental justice.

Petroleum and development in Ecuador

Ecuador, a small South American country, ranks in position 89 among 177 countries by its Human Development Index, and belongs to the medium human development group. Within Latin America, it is clearly a less developed country, with a per capita income just above half the regional average (UNDP, 2007)[1]. In Ecuador, economic diversification is low, and primary products still represent 90% of exports, mostly composed of petroleum, bananas, shrimp, coffee, cacao and flowers. Petroleum, the single most important product of the economy, accounted for 54% of total exports in the last decade, and petroleum revenues made up on average 26% of government revenues between 2000 and 2007. Social, ethnic and regional disparities, which have historically affected the country, remain pervasive, and 49% of

☆ Note: The authors have included different aspects in this article of their own publications and documents such as the original Yasuni-ITT Initiative.

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[1] Ecuador's per capita GDP was 4341 PPP (purchasing power parity) Dollars, compared with the Latin American average of 8417dollars in 2005.

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the population lived below poverty lines in 2006 (Banco Central del Ecuador, 2008; CEPAL, 2008; Larrea, 2009).

After the discovery of large petroleum reserves in the Amazonian region, Ecuador became a petroleum exporter in 1972. Initially, petroleum exports stimulated economic growth and social improvement. However, since 1982 economic growth remained elusive, inequality increased and social conditions barely improved. Per capita income grew at only 0.7% per year between 1982 and 2007. Structural unemployment remained high, and more than half of the labour force was underemployed in 2006. The environmental impacts of petroleum extraction have been severe, and Ecuador has currently one of the highest rates of deforestation in South America, with about 198,000 ha per year.

The lack of economic diversification also affects the energy supply. Ecuador has a vast hydroelectric potential, mostly in the Andean mountains, estimated at 21,122 MW, and only 8.3% of it has been developed. The potential for other renewable energy sources, mostly geothermal, solar and wind power is also regarded as important, although further research is required. Nevertheless, 47% of energy supply in 2006 came from thermal power plants, and over the past 25 years, investment in renewable energy sources has been weak, reinforcing the increasing dependence on petroleum derivatives, and even importing energy. Recently, there has been a return to public investment in hydroelectric projects, and the first steps have been taken towards future expansion of other renewable sources.

Although at first glance, it would seem obvious that countries exporting petroleum or mineral resources have relatively better chances to achieve development than other countries which lack these resources, several studies have found negative impacts of petroleum exports on development prospects.

A comparative study by the World Bank demonstrated that almost none of the petroleum-exporting countries managed to efficiently channel the resources resulting from high petroleum prices between 1973 and 1985 for their own development. In general, national economic results were disappointing, and the "Dutch Disease"[2] negatively affected prospects for economic diversification and stability (Gelb, 1988).

Jeffrey Sachs, based on empirical data of 97 developing countries between 1971 and 1989, found a negative and statistically significant correlation between natural resources exports (petroleum, minerals and primary agricultural products) and economic growth. In other words, other aspects being equal, countries specializing in exporting petroleum, minerals and other primary goods grew slower than other developing economies (Sachs, 1995).

Albert Berry, based on a comparative analysis of Indonesia, Venezuela, Chile and Nigeria, found that petroleum and mineral exporting countries have poor outcomes in job creation and income distribution (Berry, 2008). Rosemary Thorp says that, in general, mining and petroleum producer countries have encountered serious problems in their institutional development, and this weakness in turn has affected their long-term development possibilities (Thorp, 2009). In general, countries highly dependent on petroleum or mineral exports are vulnerable and fragile, and have obtained relatively poor results in terms of economic growth, diversification, institutional development, job creation and equity.

Development prospects in Ecuador are also limited by the amount of proven petroleum reserves. Currently, proven and probable reserves reach about 4.6 billion barrels, which will allow for approximately 25 years of exports, depending on future discoveries. Actually, petroleum extraction has been declining in the most important fields since 1993. Summarizing, dependence on petroleum exports has resulted in low growth and diversification, poor social performance and high environmental impacts. In the medium and long term, turning to alternative development strategies is necessary, given the limited petroleum reserves.

[2] The "Dutch Disease" theory refers to the negative effects of primary export booms on long term development prospects for industrialization and economic diversification. Booming export activities generate effects on the exchange rate and domestic demand, which over-expand both the booming traded and shielded sectors, making other traded and import competing activities less competitive. Once the boom is over, the economy is affected by low diversification and deindustrialization. The term originated in Holland after the discovery of North Sea gas (Gelb, 1988).

Ecuador's biodiversity

Ecuador is blessed by one of the most biodiverse 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, taking into account only endemic species per square kilometre. Additionally, Ecuador ranks among the first ten most abundant countries in absolute number of amphibians, birds and butterflies.

Ecuador's diversity is explained by its wide variety of climates. As the country is crossed by the Andean Mountains and the Equator, holds the Galapagos Islands, Ecuador has 17 different ecosystems, and more than half of its territory still remains with very low impact of human transformation, mostly in the Amazonian region. Within this region, the Yasuni National Park is the most important biological reserve.

The Yasuni National Park is regarded as one the most biologically diverse places on earth. It was created in 1979 and declared a UNESCO World Biosphere Reserve in 1989. The Park is located in the upper Napo basin in the western Amazon region, and has an area of 928,000 ha. Its strategic position, close to the equator and the Andean mountains, gives it climatic conditions that are unique in the Amazon region, with relatively high and uniform temperatures and rainfall levels.

Scientists agree on the park's unique value due to its extraordinary biodiversity, state of conservation and cultural heritage. The reserve has an estimated 2274 tree and bush species, and 655 species have been counted in just one hectare: 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 80 bat, 150 amphibian and 121 reptile species as well as 4000 vascular plant species per million hectares. The number of insect species is estimated to be 100,000 per hectare, the highest concentration on the planet. Furthermore, the species found in the park have a high level of endemism.

The park has the highest density of amphibious, mammal, bird and plant species in the Amazon region. In addition to high biodiversity, the projected temperature rise in the park due to climate change will be comparatively moderate, which makes the region strategically important for the future conservation of species (Bass et al., 2009; Horn, 2006).

It has been suggested that the territory was a refuge in the Pleistocene era, when glaciers drastically cooled the earth's climate, converting the majority of the Amazon region into grassland. Species concentrated in a few places—"the Pleistocene refuges"—where jungle still flourished, like Yasuni, leading to a process of speciation.

Indigenous peoples in Ecuador

Ecuador belongs to a group of Latin American countries with a significant share of indigenous peoples in the population. The group includes also Peru, Bolivia, Mexico and Guatemala. As a result, Ecuador has a rich cultural diversity, with 12 different indigenous cultures and 13 spoken languages. Since the Spanish conquest, indigenous people in Ecuador were progressively dispossessed of their lands and forced to work for the white elite under extremely hard conditions. Currently, indigenous peoples account for at least 9.2% of the population, according to the 2001 census. This figure may be underestimated. Since independence in 1830, living conditions of indigenous population improved only slowly, although coerced labour was abolished in

the 1960s. In spite of the political influence of the indigenous movement, which emerged in 1990 and is currently one of the most important in Latin America, the indigenous population is still disproportionally affected by poverty and social exclusion (Larrea and Montenegro, 2005).

Only two voluntary isolated indigenous groups exist in Ecuador, in the Yasuni National Park, the Tagaeri and Taromenane. They decided to avoid contact with western culture, and continue living with their traditional culture based on gathering, hunting and semi-nomadic agriculture. They have survived the besieging of other indigenous cultures and western civilization by penetrating deep into the interfluvial plains, like the one between the Napo and Curaray Rivers, where the Yasuni Park is located. There are approximately 300 people. The Yasuni Park is also home of about 3000 contacted indigenous peoples, who belong to the Waorani and Kichua (Quechua) ethnic groups.

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 et al., 2009). President Rafael Correa of Ecuador announced to the United Nations that Ecuador had decided to maintain the crude petroleum in the ITT field indefinitely underground, in order to put social and environmental values first, and was exploring other ways to benefit the country economically. If the international community cooperates with Ecuador by contributing at least half of the revenue that the State would receive by extracting the petroleum, the State would initially assume up to half of the opportunity cost of keeping the petroleum in the ground (Correa, 2007).

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, within the Yasuni National Park. The international community helps by providing a financial contribution, creating a capital fund to be administered by an international trust, with the participation of the Ecuadorian government, Ecuadorian civil society and (international) donors. The fund's capital will be invested in renewable energy projects in Ecuador which can promise stable and safe returns, taking advantage of the country's vast hydroelectric, geothermal, wind and solar potential, in order to overcome its current dependence on fossil fuels, which currently account for 47% of all power generation. The interest earned from this fund will be invested by the State for the following purposes, within the guidelines of the National Development Plan:

(1) Effectively conserving and preventing deforestation in 40 protected areas, totalling 4.8 million hectares, and appropriately administering five million hectares of natural areas, that belong to indigenous and Afro-Ecuadorian communities, with their active participation. The total area protected would amount to 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 peoples to remain in voluntary isolation.
(2) Reforestation, forestation, natural regeneration and appropriate management of one million hectares of forest owned by 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.

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 contributions to the international cooperation fund to keep the ITT reserves underground will come from two main sources: voluntary contributions and transactions in the carbon market. The voluntary contributions could come from:

(a) Governments of Partner Countries and International Multilateral Organizations.
  (1) Contributions from emission permit auctions or carbon taxes.
  (2) Debt-for-conservation swaps.
  (3) Other donations.
  (4) Specific projects in renewable energy generation, deforestation prevention, conservation and social development.
(b) Contributions from civil society organizations.
(c) Contributions from socially and environmentally responsible private sector companies.
(d) Contributions from citizens worldwide.

Market-based revenues from the sale of certificates of avoided emissions are not currently recognized in the carbon market and require a political agreement that recognizes the initiative as a pilot project. In exchange for the contributions, the Ecuadorian State will guarantee to maintain ITT petroleum reserves underground indefinitely. The government will issue guarantee certificates for the nominal value of the compensations (Yasuni Guarantee Certificate—CGY), up to the quantity of 407 million tonnes of carbon dioxide not emitted. The real backing for the guarantees will be the value of the investments made by the capital fund.

The Yasuni Guarantee Certificates (CGYs) for avoided emissions will not be added to the total valid emission permits, but will be part of them. In this way these certificates will not increase the total amount of emissions allowed (cap).

The revenues that the State would receive if the petroleum were to be extracted would have a present value of 6.979 billion U.S. dollars, based on the benchmark price of 61.21 U.S. dollars per barrel of WTI crude, as of May 25, 2009. The 407 million tons of CO_2 that would be generated by burning the ITT petroleum, is valued at US$ 7.19 billion, according to the current prices in the European ETS market (US$17.66 per tonne of CO_2-eq, as of May 25, 2009). Its present value is thus US$ 5.09 billion.

Ecuador proposes to countries that are sympathetic to the Yasuni-ITT Initiative the formal recognition of CGYs as carbon credits, and their integration as a pilot scheme, under specific conditions: these certificates could be (1) purchased directly by governments, or (2) purchased by companies in emission permit auctions, but subject to the condition that the CGYs will be considered within the total quota of annual emissions permits in the carbon market.

The Yasuni-ITT Initiative would open up a new mechanism to prevent greenhouse gas emissions, which involves developing countries, by leaving fossil fuel reserves located in environmentally or culturally fragile areas underground indefinitely.

Countries that could qualify for this new initiative should meet the following conditions:

(1) Be developing countries.
(2) Be megadiverse countries located between the tropics of Cancer and Capricorn, where tropical forests are concentrated. These countries house most of the planet's biodiversity.
(3) Have significant fossil fuel reserves in highly biologically and culturally sensitive areas.

Among the countries that fulfill all of these conditions are Brazil, Colombia, Costa Rica, Democratic Republic of Congo, Ecuador, India, Indonesia, Madagascar, Malaysia, Papa New Guinea, Peru, the Philippines and Venezuela.

The initiative has received the official support of various internationally recognized individuals, including; Muhammad Yunus, Desmond Tutu, Jody Williams and Rigoberta Menchú, Nobel Peace Laureates, Rita Levi Montalcini, Nobel Laureate in Medicine, ex-presidents Mikhail Gorbachev (former USSR), Felipe González (Spain), Fernando Henrique Cardoso (Brazil), Ricardo Lagos (Chile), Prince Charles of Great Britain, Danielle Mitterrand, President of the France Libertés Foundation, among others. The initiative has also received the official support of the German Parliament, with unanimous support from all the represented political parties, as well as the European Union, and other international organisms such as OPEC (The Organization of Petroleum Exporting Countries), CAN (Andean Community of Nations), CAF (Andean Development Corporation), the Organization of American States (OAS), and numerous civil society organizations, like the IUCN (International Union for Conservation of Nature and Natural Resources), and various indigenous organizations and ecological groups in Ecuador. The support of national and international civil society organizations and people is increasing.

Kyoto and beyond

In reality, the Kyoto Protocol has achieved limited results and it is unlikely that the goal of reducing worldwide CO_2 emissions below 1990 levels will be reached by 2012, given that these emissions have increased globally by 35% since 1990, and continue to do so at the rate of 2 to 3% per year (Earth Policy Institute, 2008).

One aspect of the Kyoto Protocol is the Clean Development Mechanism (CDM), the arrangement of developed countries to offset their surplus emissions (beyond their commitments under the Kyoto Protocol) through emissions reduction projects in developing countries. However, CDM projects have been widely criticized within climate change negotiations since the projects have been mainly implemented in larger and/or more advanced developing countries like China, India, Brazil, Chile, and Mexico, very few projects in the least developed countries. Another criticism of the CDM is that, being a project-based approach, it is excessively cumbersome to apply where there are many similar projects. CDM has also been criticized in relation to sustainable development, technology transfer, additionality and environmental justice (Anger et al., 2007; IPCC, 2007; Olhoff et al., 2004; Schneider, 2007; UNEP Risø Centre, 2009; UNFCCC, 2009).

For these reasons, and due to the end of the first commitment period of the Kyoto Protocol in 2012, new post-Kyoto agreements are being prepared, including stricter mechanisms and targets, such as those proposed by the European Union to reduce its emissions by 50% by 2050 or to introduce taxes on CO_2 emissions. Fulfilling these goals will demand new forms of mitigation and an international effort involving the participation of all stakeholders, under the principle of shared and differentiated responsibilities.

Reducing Emissions from Deforestation and Degradation (REDD) in developing countries is one of the mechanisms being discussed and developed. REDD includes the importance of the emissions from deforestation and degradation in developing countries, both currently not included in CDM. Furthermore, "REDD is different in scale to CDM—with rewards accruing nationally or sub-nationally rather than the smaller scale project-based approach" (Cotula and Mayers, 2009). REDD could be a cost effective way to mitigate climate change, as the Stern Review pointed out (Stern, 2007). However, REDD is also criticized by many due to several aspects. For example, during the UNFCCC Conference of the Parties (COP) meeting in Poznan in 2008, indigenous groups opposed market-based mechanisms such as REDD to resolve climate change problems and protect forests (CDM projects and REDD would be valued in terms of their emissions reductions, with only qualitative considerations for other issues). Moreover, they are concerned that REDD negotiations are not taking into account human rights instruments, such as the UN Declaration on the Rights for Indigenous Peoples (UNDRIP), and procedural rights, such as the right to Free Prior Informed Consent (FPIC). Another problem is that often poor people and indigenous groups are excluded from participation in forest management and decision making, being denied their rights and having little defence from institutional contempt, health problems, abuse, criminality, and corruption. This increases injustice and is indeed hotly debated within REDD negotiations, mainly due to civil society pressure. Next to these aspects, REDD is being questioned in relation to definitions (what are forests and what is deforestation and degradation?), financing mechanisms, monitoring requirements, and national legislations of rainforest countries (Cotula and Mayers, 2009; Schneider, 2007; UNDP, 2009).

To conclude, the Kyoto Protocol has achieved limited results since many industrialized countries failed to meet their Kyoto Protocol emission targets. Next to that, CDM is widely criticized for different reasons mentioned above. Finally, although REDD includes certain aspects which CDM does not, it seems that there are still some critical points with it, related to participation, justice, financial aspects, human and indigenous rights, monitoring, national legislation and definitions. Given these problems, Ecuador has put forward this innovative proposal, that can complement and be adopted by other climate change mitigation strategies next to other proposals, which enhances the active participation of developing countries in the mitigation of climate change, protects biodiversity, respects indigenous peoples and human rights and promotes a new style of development that is humane, equitable and sustainable. In addition it deals with the UN Millennium Development Goals. The Yasuni-ITT Initiative can be a complement of, and adopted by, other climate change mitigation strategies.

National and International Environmental Justice

The initiative can enhance in different ways national and international environmental justice, an aspect widely and increasingly discussed within the international community. One important aspect of environmental justice is related to social justice (justice among humans). Social justice is enhanced when "The welfare state favors 'the poor' because it directly addresses the needs of the least advantaged" (Davy, p. 257). Social justice also addresses the least advantaged in terms of the powerless and certain groups of society such as indigenous peoples or nations. However, environmental justice takes also environmental aspects into account like the (dis) placement of certain environmental liabilities (e.g. heavy industry or hazardous waste) in areas of the poor and least advantaged groups. In addition, there are two aspects which one can use to evaluate or examine environmental justice: procedural and distributive. Procedural aspects consist of environmental processes, policies, regulations and other political instruments. Distributive aspects relates to the outcome of the procedural aspects of environmental justice from a policy perspective (Anand, 2004). With this in mind, one can evaluate and examine the Yasuni-ITT Initiative in relation to environmental justice. However, with this evaluation and examination, we not only look at environmental justice in relation to social justice, but also in relation to justice for all people and species, including non-humans.

The Yasuni-ITT proposal can enhance national distributive environmental justice because the project protects indigenous peoples' cultures, rights and their environment, of both contacted and non-contacted groups, and will reduce national poverty. The uncontacted indigenous groups living in the Yasuni National Park (Taromenane and Tagaeri) will have the opportunity to be protected and thrive without being disturbed by the outside world. Contacted indigenous groups and urban, rural and local (contacted) populations will have the benefit of being able to implement and participate with social and environmental programs like education, health and ecotourism.

Additionally, the initiative may enhance national procedural justice and full democracy because through and with it, participation and cooperation of different stakeholders of the civil society (contacted indigenous peoples, NGOs and others) and the government will increase. This will be through the implementation of the different social and environmental programs and projects, of which some are currently in practice. The investments into different sustainable development projects will create more labour opportunities. Thus, the initiative and related projects will distribute power more equally between the government and civil society, and reinforce market mechanisms for social development.

There are several arguments for why the initiative can enhance international environmental justice and why the international community is called upon to cooperate with, and contribute to the initiative. A reason for this is that some developing countries, like Ecuador, as seen in former sections, have been developing in an unsustainable way, exporting mainly primary products, which resulted in low economic growth and diversification, poor social performance, high environmental impacts, inequity and non-poverty reduction. This has been through the international demand for natural resources, and national aspects such as the high quantity of natural resources (like petroleum) and primary products, high unemployment rates, high external debts, capital scarcity and the low costs of labour. Usually, this process is a self-enforcing cycle, in which some developing regions have been specializing in the export of natural resources, which creates a lock-in situation.

This same process has had significant effects on the Ecuadorian environment, economy and society. This is furthermore enforced by the lack of financial resources and general incapacity (due to foreign debts, poverty, and institutional problems), which makes the country unable to transform into a sustainable society which respects indigenous cultures, rights and their environment, increases civil society participation and democracy, and constructs a solid financial and institutional foundation in order to achieve effective and permanent conservation of nature and environment without dependence of foreign investments.

The Yasuni-ITT Initiative can assist Ecuador to overcome these international environmental injustice and economic problems.

The Initiative may lead to distributive international environmental justice in terms of social–environmental North–South and international rich-poor relations, since Ecuador would be able to develop better and more sustainably through the contribution of different countries, especially developed/rich countries. The Initiative can enhance procedural international environmental justice, since Ecuador is proposing the Initiative itself into international institutional and procedural declarations and policies, which can lead to more participation, empowerment and equality of the country within international negotiations.

In addition, to enhance distributive and procedural international environmental justice for the whole globe, and to be able to combat climate change, it is often argued that not only developed countries, but also developing countries, need to act to lower total greenhouse gas emissions. That is also why many opt for having binding greenhouse gas emissions for every country. With this in mind, the intention of the Yasuni-ITT Initiative is that megadiverse developing countries with fossil fuel reserves act upon climate change and other issues such as the use and extraction of fossil fuels, deforestation, biodiversity loss and poverty.

Furthermore, although environmental justice is generally referred to in relation to justice among humans, it can also be referred to in relation to all species of the planet. In this sense, the Yasuni-ITT initiative might enhance also international environmental justice when referring to all species since it will protect and preserve biodiversity in Yasuni, and 40 other natural areas of Ecuador. Besides, there is an international human value of the preservation of these areas since the Amazon, and especially Yasuni, hosts the greatest amounts of species, which is important for medicine and genetic information.

Finally, when referring to international environmental justice, the Yasuni-ITT Initiative can also enhance international intergenerational justice due to the fact that it combats climate change in different ways, preserves biodiversity, protects indigenous rights and implements the use of sustainable energy sources on long term basis, thus including different generations of all living beings on earth (Davy, 1997; Low and Gleeson, 1998; Muradian, 2001).

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