INTERNATIONAL JOURNAL OF PROFESSIONAL BUSINESS REVIEW
ISSN: 2525-3654
OPEN ACCESS

THE CARBON FOOTPRINT AND MONETARY VALUE OF ENVIRONMENTAL IMPAIRMENT BY THE DISPLACEMENT TOWARDS PROTECTED AREAS IN ECUADOR

Jaime Fabián Díaz Córdova[A], Edisson Marcelo Coba Molina[B], Héctor Santiago López Zurita[C], Estefanía de las Mercedes Zurita Meza[D]

ARTICLE INFO

Article history:

Received: February, 06th 2024

Accepted: April, 26th 2024

Keywords:

Environmental Economy; Environment Degradation; Sustainable Development; Economic Value.

ABSTRACT

Objective: Generate environmental awareness and economic valuation of the pollution caused by the movement of people to the protected areas (PA) of Ecuador from the city of Ambato.

Theoretical Framework: The perspectives of alternative development and sustainable development models provide the theoretical framework that supports this work and allows us to envision alternatives for solving environmental conflicts such as pollution and environmental deterioration of the country's protected areas.

Method: The methodology used was built based on environmental assessment methods. Thus, first, the country's protected areas were identified, and the distances from Ambato to the PAs in kilometers were calculated. Then, the fuel used for the trip was calculated, as well as the fuel consumption of the round trip, which helped to obtain the carbon footprint generated by the transfer and determine the environmental cost of the carbon dioxide emission.

Results and Discussion: The investigation results determined that the cost of environmental contamination when visiting the 47 Ecuadorian protected areas was $395,391.37.

Research Implications: However, the contribution of this study focuses on providing evidence that conserving nature is more profitable than exploiting it.

Originality/Value: The study demonstrates the need to change transportation for a sustainable mobility system to achieve social, economic, and environmental balance.

Doi: https://doi.org/10.26668/businessreview/2024.v9i5.4632

A IMPRESSÃO DIGITAL DO CARBONO E O VALOR ECONÔMICO DA DETERIORAÇÃO AMBIENTAL, PELO DESLOCAMENTO EM DIREÇÃO AS ÁREAS PROTEGIDAS NO EQUADOR

RESUMO

Objetivo: Gerar consciência ambiental e valorização econômica da poluição causada pelo movimento de pessoas para as áreas protegidas (UC) do Equador a partir da cidade de Ambato.

Referencial Teórico: As perspectivas de desenvolvimento alternativo e de modelos de desenvolvimento sustentável forneceram o quadro teórico que sustenta este trabalho e permitem vislumbrar alternativas para a solução de conflitos ambientais como a poluição e a deterioração ambiental das áreas protegidas do país.

Método: A metodologia utilizada foi construída com base em métodos de avaliação ambiental. Assim, primeiro foram identificadas as áreas protegidas do país e calculadas as distâncias de Ambato às UCs em quilômetros. Em

[A] *PhD in Business Administration Universidad Técnica de Ambato. Ambato, Ecuador.*
E-mail: jaimefdíaz@uta.edu.ec Orcid: https://orcid.org/0000-0002-5406-4160
[B] *PhD in Business Administration Universidad Técnica de Ambato. Ambato, Ecuador.*
E-mail: edisoncoba@uta.edu.ec Orcid: https://orcid.org/0000-0003-4548-948X
[C] *Master of Science in Global Technology and Development. Universidad Técnica de Ambato. Ambato, Ecuador.*
E-mail: slopez@uta.edu.ec Orcid: https://orcid.org/0000-0002-0604-9855
[D] *Master in Accounting with Mention in Costs. Universidad Técnca de Ambato. Ambato, Ecuador.*
E-mail: tefa-merce92@gmail.com Orcid: https://orcid.org/0000-0001-5509-0152

seguida, foi calculado o combustível utilizado para a viagem, bem como o consumo de combustível da viagem de ida e volta, o que ajudou a obter a pegada de carbono gerada pela transferência e a determinar o custo ambiental da emissão de dióxido de carbono.
Resultados e Discussão: Os resultados da investigação determinaram que o custo da contaminação ambiental ao visitar as 47 áreas protegidas equatorianas foi de US$ 395.391,37.
Implicações da Pesquisa: Contudo, a contribuição deste estudo centra-se em fornecer evidências de que conservar a natureza é mais rentável do que explorá-la; assim
Originalidade/Valor: O estudo demonstra a necessidade de mudança do transporte para um sistema de mobilidade sustentável para alcançar o equilíbrio social, econômico e ambiental.
Palavras-chave: Economia Ambiental, Degradação Ambiental, Desenvolvimento Sustentável, Valor Econômico.

LA HUELLA DE CARBONO Y EL VALOR ECONÓMICA DEL DETERIORO AMBIENTAL POR EL DESPLAZAMIENTO HACIA LAS ÁREAS PROTEGIDAS EN EL ECUADOR

RESUMEN
Objetivo: Generar conciencia ambiental y valoración económica de la contaminación provocada por el desplazamiento de personas hacia las áreas protegidas (AP) del Ecuador desde la ciudad de Ambato.
Marco Teórico: Las perspectivas del desarrollo alternativo y los modelos de desarrollo sostenible proporcionaron el marco teórico que sustenta este trabajo y permiten vislumbrar alternativas para la solución de conflictos ambientales como la contaminación y el deterioro ambiental de las áreas protegidas del país.
Método: La metodología utilizada se construyó sobre la base de los métodos de avaluación ambiental. Así, primero se identificaron las áreas protegidas del país y se calcularon las distancias desde Ambato a las AP en kilómetros. Luego, se calculó el combustible utilizado para el viaje, y el consumo de combustible del viaje de ida y vuelta, el mismo que ayudó a obtener la huella de carbono generada por el traslado y determinar el costo ambiental de la emisión de dióxido de carbono.
Resultados y Discusión: Los resultados de la investigación determinaron que el costo de contaminación ambiental al visitar las 47 áreas protegidas ecuatorianas fue de 395.391,37 dólares.
Implicaciones de la investigación: Sin embargo, la contribución de este estudio se enfoca en aportar evidencia de que conservar la naturaleza es más rentable que explotarla.
Originalidad/Valor: El estudio demuestra la necesidad de cambiar el transporte por un sistema de movilidad sostenible para lograr un beneficio social, económico, y equilibrio ambiental.

Palabras clave: Economía Ambiental, Degradación Ambiental, Desarrollo Sustentable, Valor Económico.

1 INTRODUCTION

Throughout history, the problem of environmental deterioration has acquired great importance due to its direct relationship with the economic development model that leads to the exploitation and indiscriminate use of natural capital. This problem has taken shape in the seventies, becoming a constant multidisciplinary study and questioning, and holding developed countries responsible for the ecological deterioration due to the irresponsible way of consuming environmental goods and services (Erdenekhuu et al., 2022).

Later, in the 1980s, the possibility of harmonizing the objectives of economic growth and environmental sustainability was raised thanks to the social awareness raised by the United Nations Organization and the Commission for Environment and Development, allowing the issuance of a report entitled Our Common Future, where the ecological issue and Sustainable

Development appear as new trends. From this decade onwards, the environmental crisis took substance and form, promoting the use of economic- environmental terms that seek to introduce ecological standards and regulations to help solve the environmental problem without repressing the economic growth of the countries.

The objective of this article is to propose a method that allows knowing the monetary value of the deterioration caused by carbon dioxide (CO2) when visiting or traveling to natural areas of Ecuador from the city of Ambato. This work takes as reference valuation methods such as the cost of travel applied to the protected areas of Ecuador and the costs generated in traveling to them.

1.1 THE ENVIRONMENT IN LIFE

The environment has played an important role in the development of human beings throughout history and is found in culture, religion, myths, and legends. In the prehistoric era, the relationship between man and nature was conceptualized as symbiotic, where natural resources were used as survival elements without the environment being modified, developing mainly basic hunting and fishing techniques (Ochoa Figueroa, 2014). Later with the passing of time along with the Neolithic evolution a social and technological change occurred after the settlement of nomads and the creation of kingdoms, perfecting techniques to harness energy, agriculture, and domestication of animals and plants, among others (Severiche-Sierra et al., 2016).

The environment is a system of elements among which there is a network of mechanisms that interrelate them with each other. Cifuentes (2008) defines it as the surroundings that affect and condition the life circumstances of people or society, comprising a group of natural, social, and cultural values existing in a place that influences the life of man. The environment is made up of physical factors (climate, geology), biological (human population, flora, fauna, water), and social factors (labor activity, urbanization, social conflict) that interact with each other, fulfilling a successive and constant process in which all the elements are dependent, forming the ecological system (Cantú Martinez, 2002). In addition, from the economic point of view, there must be a balance between productive activity and the exploitation of non-renewable resources (Alcántara, 2003).

1.2 THE GLOBAL ENVIRONMENTAL CRISIS

Technological and industrial progress has caused a critical tension in the permanence of the planet and the capacity to support the pace of human life, although the development of the economic system depends on this factor, there is a threat due to the uncontrolled use of natural resources (Calvo et al., 2016). The industrial revolution and the emergence of the capitalist economic model originated large changes in the environment, breaking the relationship between human beings and the environment. In Europe, the increase in population, decrease in infant mortality, and high birth rates were the outstanding events that caused the rising of inhabitants from 115 million to 190 million between 1700 and 1800, and by the end of the 19th century, the population had reached 400 million inhabitants, resulting in high industrial activity and accelerated deterioration of the natural environment with the manufacture of processed products (Tommasino & Foladori, 2001).

Agriculture has caused erosion and loss of organic matter in the soil because of the use of fertilizers and chemical products in the cropping system (Alcántara, 2003). Livestock activity also contributes to the pollution process causing an imbalance in the environment due to the emission of greenhouse gases caused by the decomposition of manure, animal digestion and chemical residues (Lorente Saiz, 2010).

1.3 MODIFICATIONS OF NATURE BY HUMAN INTERACTION

The changes in the behavior of human production have an effect on nature that can be seen from several approaches or ways of analyzing them, such as changes in their: a) rhythm, b) amplitude, c) level, d) depth, and e) degree of awareness.

The changes in rhythm are related to the capitalist economic model causing the intensive use of natural elements and greater generation of waste. The modifications of amplitude are reflected in the accelerated extraction of natural resources. The modifications under the level approach refer to the changes in the use of energy; however, the new industrial society drives its development in the improvement and use of fossil fuels, coal, oil and electricity implying the contamination of ecosystems by the alteration and combination of elements (Song et al., 2022). The in-depth approach refers to the discovery of biotechnology, the development of satellites, the manufacture of biodegradable products, among others, which emphasize mankind's concern for the deterioration of the environment. Finally, we have the modification of nature from the focus on the degree of awareness that refers to the concern in the human being after perceiving the depletion of natural resources (Estenssoro, 2010) as shown in Table 1.

Table 1

Evolution of the planet in the period 1992-2011

Environmental and social issues		Period / Year	Data
Social dimension	Population and human development	1992-2010	Population growth: +26% (1450 million people)
		2008	More than 2.5 billion people lack access to water sanitation services
		2008	1.4 billion people lack electricity.
		2011	3.5 billion people live in urban areas, 24% of them in slums.
	Economy and consumption	1992-2010	GDP growth: +39% globally, but +80% in developed countries and +33% in developing countries
		1992-2005	Demand for raw materials: +41%.
		1992-2009	Replacement of primary forest by sugar cane (+30%), soybeans (+75%) and palm oil (+120%).
		1992-2008	Depletion of fish stocks: +33%.
Environmental Dimension	Atmosphere	1992-2008	CO2 emissions: +36%.
	Climate change	1992-2010	Global average temperature: +0.4% °C
		1992-2011	Sea level rise: 2.5mm/year
	Forests	1990-2010	Deforestation of 300 million hectares of forest, especially in Africa and South America.
	Biodiversity	1992-2007	30% decrease in the tropics

Source: Casas Jericó and Puig Ibaguer (2017), UNEP (2012).

1.4 ENVIRONMENTAL DEGRADATION

One of the great global concerns, treated as a process immersed within the dynamics of the environmental crisis, technically refers to the transformation of the original ecosystems which generates the impoverishment of their physical and functional properties related to the decrease in quality, quantity of energy and resources as shown in Table 2, used within the daily activities that the man fulfills for his survival, associating it with socioeconomic aspects attributing to the development and overconsumption, the dependence of the technology, the unequal access to the resources, the growth of the human populations and the poverty as determinants of the environmental crisis and the degree of severity of the same one (Landa et al., 1997).

Authors such as Zurita, Baddi, Guillen, Lugo and Aguilar (2015) relate environmental deterioration to the way in which a country develops its economic activities and the procedures it uses to exploit its natural resources, thus causing changes and alterations considered as harmful and irreparable (Tommasino & Foladori, 2001). These changes are reflected in the depletion of resources such as air, water and soil, in addition to the destruction of ecosystems and the extinction of wildlife.

Table 2

Main causes of environmental degradation

Factor	Description
Population growth	Overpopulation, currently the world birth rate corresponds to 1.2% so that mortality has a lower level.
Urbanization	Change of land use, which is the transformation of a forested or green area to become a city, which requires resources such as water, energy, and food to maintain its life and development process.
Agriculture	Globally, agriculture directly contributes between 10% and 12% of greenhouse gas emissions because agricultural soils and livestock emit large amounts of gases into the atmosphere.
Livestock	Livestock lands occupy more than 26% of the land surface and 80% of the total agricultural surface so it is considered as the main cause of soil quality degradation mainly in Mexico, Central and South America.
Fishing	Unsustainable fishing activity and its excessive growth, the capture of associated species, the scant attention to the illegal capture of endangered varieties and the discharge of effluents with chemical waste generate impacts on marine ecosystems, causing overexploitation and modification of the natural habitat.
Industry	Activity that reflects large-scale pollution in the air, water, and soil as a result of waste and chemicals resulting from production processes, causing it to face major challenges within the framework of environmental sustainability that promote the mitigation of environmental degradation.
Transport	The disproportionate growth of transport and the need for infrastructure construction have generated greater dependence on the extraction of petroleum resources causing enormous CO2 emissions.
Overexploitation of natural capital	The ever-expanding consumption of natural resources (oil, timber, minerals, biodiversity, etc.) puts a strain on the environment, with emissions and waste polluting the earth and destroying ecosystems.

Source: Own elaboration based on (Zurita et al., 2015).

1.5 INTERNATIONAL REGULATIONS FOR THE PRESERVATION OF THE ENVIRONMENT

Table 3

Agreements and conventions signed at the international level

Approach	Year	Agreement/Protocol
Desertification		International Convention to Combat Desertification
Forests	1972	Statement of Forest Principles
		Ramsar Convention on Wetlands
		Intergovernmental Forum on Forests
	2000	United Nations Forum on Forests
	2006	Mountain Partnership
	2011	International Year of Forests
	2011	Convention on International Trade in Tropical Timber
Ozone layer	1985	Vienna Convention on the Protection of the Ozone Layer
	1987	Montreal Protocol
Climate change	1992	United Nations Framework Convention on Climate Change

		Kyoto Protocol
	2009	15th Climate Change Conference - Copenhagen Summit
	2015	Treaty of Paris
Water	1981 1990	International Drinking Water Supply and Sanitation Decade
	2003	International Year of Water
	2005 2015	Water for Life Decade
Energy	2014	UNEP Energy Program
Biodiversity	1992	Convention on Biological Diversity
	1973	International Convention on the Conservation of Endangered Species of Wild Fauna and Flora
	1988	Convention on International Trade in Endangered Species of Wild Fauna and Flora
	2000	Cartagena Protocol on Biosafety
	2010	International Year of Biodiversity
	2011	Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising out of their Utilization
Marine Environment	1982	Convention of the Sea
	1998	Inter-American Convention for the Protection and Conservation of Sea Turtles
	2008	International Whaling Commission

Source: Ekolankidetza (2012)

The agreements and conventions described in Table 3 are classified according to the element and focus of the environment they represent, with the name of the program and their descriptions in chronological order; in addition, of these agreements, carbon pricing (main pollution gas) is currently used for the reduction of greenhouse gas (GHG) emissions, with more than 40 countries already using this mechanism and about 20 cities planning to implement it, as well as carbon pricing that contributes to the reduction of emissions (World Bank Group, 2020) (World Bank, 2016) and can also define a tax rate on GHG emissions as generated by the Australian Carbon Pricing Mechanism (CPM); New Zealand Emissions Trading System (NZ ETS), 2013; Western Climate Initiative (WCI), 2013; and, 7 Pilot Plan 7 in China Emissions Trading Systems. (Funseam, 2014).

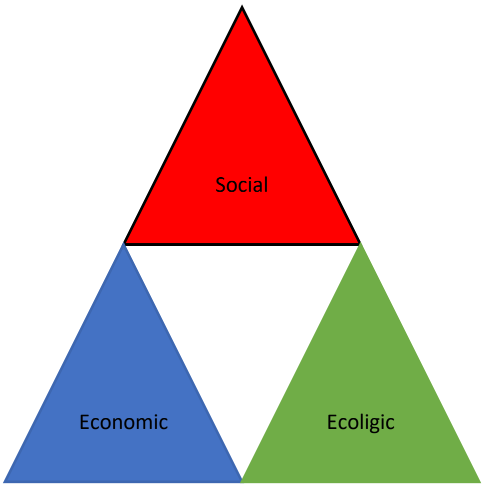
1.6 SUSTAINABLE DEVELOPMENT

In the 1970s, the debate on economic growth changed, incorporating within the growth models the environmental variable (Aguado et al., 2009). The term sustainable development appears in the report Our Common Future also known as Brudtland Report, where its definition explains that current needs must be met without compromising future generations which means that in the context of Sustainable Development, natural resources are not wasted or exhausted and unnecessary injuries to the environment and human beings are avoided (Alaña et al., 2017).

Thus, in 1992 through the first Earth Summit held in Rio de Janeiro, sustainable development was adopted, generating international agreements to address the crises, in this way should be considered three important aspects within sustainable development such as: economic, social and environmental.

Figure 1

Sustainability dimension



Source: Calvo et al. (2016).

According to Calvo, Molina, and Salvachúa (2016) Economic sustainability involves industrial growth, remuneration of jobs, financial performance, meeting household needs, and contributions to the community. Ecological sustainability seeks the conservation of natural resources, the preservation of clean soil, water and air, the integrity of ecosystems and biological diversity, while social sustainability entails public benefit, labor equity, participation, dignified treatment of employees, preservation of cultures and human health.

1.7 PROTECTED AREAS

The search for development models that allow the separation of natural areas from human intervention led to the worldwide creation of protected areas, aimed at the conservation of the natural wealth of a specific place. (Rojas, 2014). The first protected area that is recorded is the Yellowstone Park in the United States in 1872, another protected place was the Royal

National Park of Australia in 1879 located in New South Wales, being the second oldest national park in the world. (D'Amico, 2015).

In Latin America conservation through protected areas appear in Mexico in 1876 with the protection of the desert of Los Leones. In 1917, regulations and limitations for the use of natural resources are established, initiating a process of implementation of public policies on the conservation of ecosystems (Gómez-Castro, Samón-Veloso, & Brull-González, 2018) and the protection of natural, cultural, tourism and educational characteristics, practicing the sustainable use of resources and the maintenance of the natural and cultural attributes of the protected ecosystems. (Rojas, 2014).

In this way the most used definition of Protected Area is that of IUCN (International Union for Conservation of Nature) which defines it as a geographical space clearly delimited, recognized, dedicated and managed by legal means to achieve long-term conservation of biological diversity and associated natural and cultural resources, expanding its content in management categories, classifying them according to the different management objectives, promoting worldwide the importance of protected areas for human survival, currently there are six categories as presented in Table 4 (Borrini et al., 2014).

Table 4

Category of UINC protected areas

No.	Protected area category and international name	Management objective
Ia	Strict nature reserve	Strictly protected area, dedicated to conserving biodiversity and local geological/geomorphological features, where visits are strictly controlled and limited. They serve as a reference for scientific research and monitoring.
Ib	Wilderness Area	Extensive unmodified or slightly modified areas, to preserve their natural condition.
II	National Park	Extensive natural areas dedicated to the protection of large-scale ecological processes provide environmentally and culturally compatible spiritual, scientific, educational, recreational, and tourism opportunities.
III	Natural Monument	Areas dedicated to protecting a specific natural monument, such as a geographical feature, a seamount, a cave or even a living feature such as an ancient forest.
IV	Habitat/species management area	Areas dedicated to the conservation of species or habitats.
V	Protected landscape/seascape	An area where the interaction between people and nature produces significant ecological, biological, cultural, and scenic values.
VI	Protected area with sustainable use of natural resources	Protected areas consider the limited and non-industrial use of natural resources compatible with nature conservation as one of the main purposes of this type of protected area.

Source: Borrini et al. (2014), Ministry of Environment MAE (2013).

1.8 SYSTEM OF PROTECTED AREAS IN ECUADOR

Protected areas deliver ecosystem services of great economic, environmental and cultural value, which is why the National System of Protected Areas in Ecuador meets the objective of maintenance and conservation of natural heritage and unique existing biodiversity, resulting from the recognition of the rights of nature addressed in the Constitution of the Republic, Art. 405 and its follow-up implemented in the National Plan of Good Living where it marks biodiversity as the main competitive advantage of the country and a source of economic, environmental and social development. (Ministry of Environment Ecuador, 2016). The National System of Protected Areas is the country's main conservation strategy. Ecuador (Dirección Nacional de Biodiversidad, Centro de Información Ambiental CIAM, 2004).In Ecuador, with species that extend in the four geographic regions covering an area of approximately 20% of the national territory and the conservation of a unique system such as the Galapagos Islands, it is the main conservation strategy of the country. (Ministry of Environment, 2012) (Ministry of Environment Ecuador, 2016).

The National System of Protected Areas consists of 11 National Parks, 5 Biological Reserves, 1 Geobotanical Reserve, 9 Ecological Reserves, 4 Marine Reserves, 6 National Recreation Areas, 4 Wildlife Production Reserves, 10 Wildlife Refuges and 1 Municipal Ecological Conservation Area as shown in Table 5.

Table 5

Areas of Ecuador recognized by the SNAP (National System of Protected Areas)

Natural Area		Area in hectares			Date of creation
		Terrestrial	Marina	Total - ha	
1	Cajas National Park	28.808	-	28.808	06/06/1977
2	Cotopaxi National Park	33.393	-	33.393	11/08/1975
3	Galapagos National Park	693.700	-	693.700	14/05/1936
4	Llanganates National Park	219.932	-	219.932	22/11/2012
5	Machalilla National Park	56.184	-	56.184	26/07/1979
6	Podocarpus National Park	146.280	-	146.280	15/12/1982
7	Sangay National Park	502.105	-	502.105	32282
8	Sumaco National Park	205.249	-	205.249	34395
9	Yasuní National Park	982.000	-	982.000	26/07/1979
10	Yacuri National Park	43.091	-	43.091	30/12/2009
11	Limoncocha Biological Reserve	4.613	-	4.613	23/09/1985
12	Galapagos Marine Biological Reserve	-	14.110.000	14.110.000	07/11/1996
13	Antisana Ecological Reserve	120.000	-	120.000	21/07/1993
14	Arenillas Ecological Reserve	13.170	-	13.170	18/07/2012
15	El Angel Ecological Reserve	15.715	-	15.715	05/08/1992
16	Cayambe Coca National Park	403.103	-	403.103	17/11/1970
17	Cayapas Mataje Ecological Reserve	51.300	-	51.300	26/10/1995

18	Ecological Reserve Cofán Bermejo	55.451	-	55.451	30/01/2002
19	Ecological Reserve Cotacachi Cayapas	243.638	-	243.638	29/08/1968
20	Los Ilinizas Ecological Reserve	149.900	-	149.900	11/12/1996
21	Mache Chindul Ecological Reserve	119.172	-	119.172	09/08/1996
22	Manglares Churute Ecological Reserve	50.068	-	50.068	26/09/1979
23	Pululahua Geobotanical Reserve	3.383	-	3.383	28/01/1966
24	Chimborazo Fauna Reserve	58.560	-	58.560	26/10/1987
25	Cuyabeno Wildlife Reserve	603.380	-	603.380	26/07/1979
26	Manglares El Salado Wildlife Production Reserve	10.635	-	10.635	09/08/2012
27	Pasochoa Wildlife Refuge	500	-	500	11/12/1996
28	Muisne River Estuary Mangrove Wildlife Refuge	3.173	-	3.173	28/03/2003
29	Isla Corazon Y Fragatas Wildlife Refuge	2.812	-	2.812	28/11/2012
30	Santa Clara Island Wildlife Refuge	5	-	5	06/03/1999
31	La Chiquita Wildlife Refuge	809	-	809	21/11/2002
32	El Boliche National Recreation Area	400	-	400	26/07/1979
33	National Recreation Area Park-Lake	2.283	-	2.283	15/11/2002
34	El Zarza Wildlife Refuge	3.643	-	3.643	28/06/2006
35	El Condor Biological Reserve	2.440	-	2.440	04/06/1999
36	El Quimi Biological Reserve	9.071	-	9.071	03/10/2006
37	Manglares El Morro Wildlife Refuge	10.030	-	10.030	12/09/2007
38	Esmeraldas River Estuary Mangrove Wildlife Refuge	242	-	242	13/06/2008
39	Pacoche Coastal Marine Wildlife Refuge	5.044	8.586	13.630	02/09/2008
40	Puntilla Santa Elena Coastal Marine Faunal Production Reserve		52.231	52.435	05/11/2012
41	Marina Galera San Francisco Reserve	-	54.604	54.604	23/09/2008
42	Samanes National Recreation Area	852	-	852	28/11/2012
43	Santay Island National Recreation Area	2.214	-	2.214	20/02/2010
44	El Pambilar Wildlife Refuge	3.123	-	3.123	18/03/2010
45	Cerro Plateado Biological Reserve	26.115	-	26.115	31/08/2010
46	Playas de Villamil National Recreation Area	2.478	-	2.478	05/09/2011
47	Quimsacocha National Recreation Area	3.217	-	3.217	25/01/2012
48	Municipal Ecological Conservation Area Siete Iglesias	16.029	-	16.029	31/05/2012
49	El Pelado Marine Reserve		13.005	13.102,35	24/08/2012
50	Rio Negro-Sopladoras National Park	30.616,28		30.616,28	15/03/1971
51	Cantagallo-Machalilla Marine Reserve		142.266,45	142.266,45	19/05/2015
52	Bajo Cope Marine Reserve		39.952	39.952	29/11/2016
53	Samama Mumbes Wildlife Refuge	2.145,56		2.145,56	23/05/2016
54	La Bonita Municipal Ecological Conservation Area	53.072,65		53.072,65	24/08/2017
55	Colonso Chalupas Biological Reserve	93 246		93 246	26/02/2014

Source: Frenkel and Rodas (2017), Ministry of Environment MAE (2013).

1.9 ENVIRONMENTAL ECONOMICS

Currently the reality of the world shows a constant growth not only economic but demographic, so it is evident the need to generate alternatives that allow the continuous development of the economy, but at the same time and in parallel to implement measures that do not limit it and contribute to achieve the sustainable development of a nation. Under this concept the environmental economy arises, with the purpose of proposing favorable ways that promote the optimization of resources. (Fernández & Gutiérrez, 2013) (Contreras, 2016)

It should be emphasized that Environmental Economics is not the application of science to environmental problems, but rather refers to the incorporation of the environment as an object of study within the economy, so we can say that this branch bases its studies on the analysis of scarcity of goods and their incorporation into a market through the process of externalization, granting economic value and property rights as long as these goods are managed under a concept of sustainability proposed at a global level.

1.10 ENVIRONMENTAL ECONOMIC VALUATION

Natural resources are considered as free and priceless goods, these are established as property rights, facilitating their use and exploitation, causing the ignorance of their economic value in the market, accounting only for the profits generated by their direct or indirect sale of them. A possible way out is the construction of updated and timely information by means of evaluations, quantification, and valuation of use and losses of the goods, which allow knowing their evolution and dynamics as well as the cost generated after their use. (Navarro Gómez, 2016)The main methods of environmental economic valuation used in ecosystems are presented below in Table 6.

Table 6

Main environmental valuation methods

Method	Features
Replacement cost	The economic value of the good or service is estimated as the financial cost of its restitution or replacement by means of a man-made technology.
Cost avoided	Used when the environmental good and the market good are substitutes, it estimates the value that would have had to be incurred if the environmental good or service is affected.
Production function	Used when the supply of an environmental good or service is determinant in the production function of a good or service, affecting costs and supply in the market.
Travel cost	It represents the costs incurred by a person to get to a place, as well as the value willing to pay to access a space.

Hedonic pricing	Determines the impact of the environmental good or service on the price of a good or property.
Contingent valuation	It values the benefits of an environmental improvement through the monetary amount that the potential beneficiaries of the improvement would be willing to pay for it.

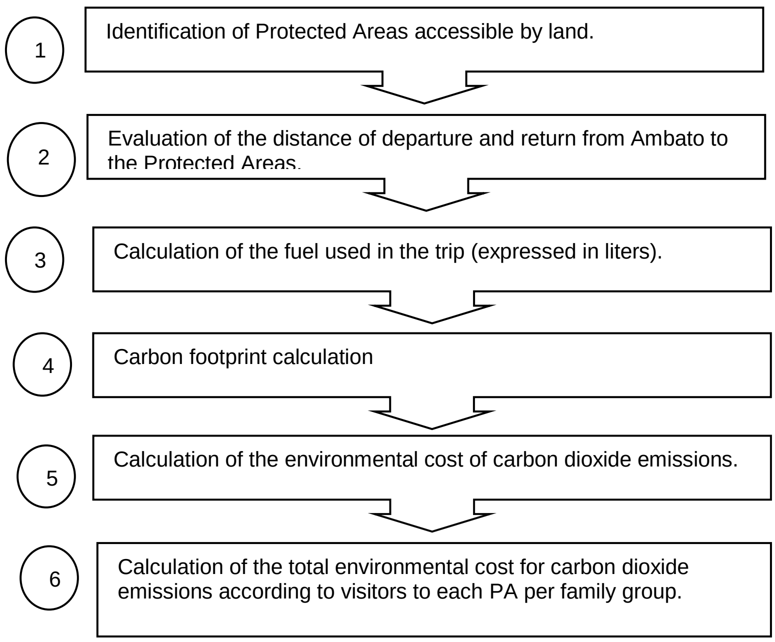
Source: Own elaboration based on (Delacámara, 2008)

2 METHODOLOGY

For this study we considered the Protected Areas of Ecuador registered in the National System of Protected Areas (SNAP), which have access by land, taking as initial displacement the city of Ambato located in the center of the country for being considered as one of the strategic city of trade and distribution of goods and services to the regions: Highlands, Coast and Amazon regions of Ecuador. The following is a flow chart that summarizes the activities carried out during the execution of the methodology for the economic valuation of carbon dioxide emissions: Figure 2 Schematic of the methodology used for the economic valuation of CO2 emissions from vehicles.

Figure 2

Schematic of the methodology used for the economic valuation of CO2 emissions from vehicles.



Source: Compiled by author's

The specifications of the procedures carried out in the proposed methodology are continuously shown:

A table was made with the country's protected areas, classifying them by region and location, considering only those PAs that can be reached by land with the use of a vehicle.

Next, we proceeded to calculate the round-trip distance between the city of Ambato as a reference point and each of the areas detailed in Table 10.

Next, the amount of fuel consumed expressed in liters was calculated, taking into account the type of displacement in vehicles ≥ 1000cc ≤ 1600cc, using the study of Mendez and Palacios, (2017) where they describe the vehicle models Chevrolet, Aveo Active, Kia Sportage and others of similar characteristics and dse used the formula.

$$LC = K * 0{,}1204282 \qquad (1)$$

With the formula developed we proceeded to calculate the amount of C02 emitted for each liter of gasoline consumed, multiplying the number of liters of gasoline consumed by a vehicle for 2.28 kilograms which is the amount of carbon dioxide emitted for each liter used, data that was taken as a reference from the study conducted by Fernandez, Fernandez, Mosquera and Mosquera. (2010)

$$HCO2 = LC * 2{,}28 \qquad (2)$$

From the calculation of the amount of HCO2 in kilograms per liter consumed, the cost of HCO2 was calculated based on carbon pricing according to World Bank data, obtaining an average of 0.0055 for the year 2017 of prices set by China, European Union, Colombia and USA. (World Bank Group & Ecofys, 2017). (See Table 9).

$$CCO2 = HCO2 * 0{,}0055 \qquad (3)$$

Finally, we proceed to calculate the total environmental cost of carbon dioxide emissions spread in the air due to gasoline combustion, according to the number of national visitors to each Protected Area we obtain the value of the number of families that have traveled in a vehicle, taking as data the average number of people per household of 3.78 according to the INEC. (2010)We obtain the number of groups that have traveled in a vehicle to the different PAs, NVGF = NVN/ 3,78 (Ministry of the Environment, 2017).

$$TCO2 = CCO2 * NVGF \qquad (4)$$

$$TCO2 = CCO2 * NV \qquad (5)$$

Table 7

Nomenclature used in the table for calculating the environmental value of impairment.

Nomenclature	Detail
V	Access road
D	Distance between Ambato and the Protected Area expressed in kilometers.
DT	Distance of departure and return between Ambato and the Protected Area expressed in kilometers.
LC	Liters of fuel consumed during the trip
HCO2	Carbon footprint expressed in Kilograms
CCO2	CO2 emission cost from carbon pricing.
NVN	Number of visitors in 2017
TCO2	Total cost per CO2 emission according to number of visitors
NVGF	Number of vehicles per household
TCO2GF	Total cost per CO2 emission according to number of visitors per household group

Source: Compiled by author's

The nomenclature in Table 7 allows the identification of the variables used in the monetary valuation model, which allow the calculation of the environmental cost of CO2 emissions, then Table 8 is presented exemplifying the calculation by applying each PA.

Table 8

Description of variables

AP1	(SNAP, 2017)	Méndez and Palacios, (2017)	Mosquera J., Fernández & Mosquera (2010)	(World Bank Group & Ecofys, 2017)
	Distance (D) km2	Liters * Km travelled (LC) (0,1204282)	Amount of HCO2 in kg. per Liter consumed (2.28 kg.)	Pricing per kilogram = $0.01 USD
Calculation				
AP1	DT	LC	HCO2	CCO2
	413	413*0,1204282 = 49,79	49,79*2,28 = 113,51	113.51*0.01 = 0.91 USD

Source: Compiled by author's

Table 9

Carbon pricing

China	European Union	Colombia	USA	Average	Average per kg
$9 USD/tCO2	$5 USD/tCO2	$5 USD/tCO2	$3 USD/tCO2	5,5	5,5/1000= 0,0055

Source: World Bank Group & ECOFYS (2017)

Table 10

Model of monetary mitigation of environmental degradation per trip to Ecuador's Protected Areas

Region	No.	Protected Area	V	D	DT	LC=(DT*0.1204282)	HCO2=(LC*2,28)	CCO2= HCO2*0.01	NVN	TCO2= NVN*CCO2	NVGF= NVN/3,78	TCO2 GF= NVGF*CCO2
Interandina	1	Colonso Chalupas Biological Reserve	Bathrooms	206,70	413,40	49,79	113,51	0,62	177,00	110,50		29,23
	2	Cajas National Park	Basin	347,80	695,60	83,77	191,00	1,05	78954,00	82939,12	20887	21941,57
	3	Cotopaxi National Park	Latacunga	7 -	14 -	16,86	38,44	0,21	169702,00	35879,03	44895	9491,81
	4	Llanganates National Park	Pillaro	6 -	12 -	14,45	32,95	0,18	16643,00	3016,05	4403	797,90
	5	Podocarpus National Park	Loja - Vilcabamba	587,20	1174,40	141,43	322,46	1,77	13576,00	24077,62	3592	6369,74
	6	Sangay National Park	Macas	127,90	255,80	30,81	70,24	0,39	16361,00	6320,28	4328	1672,03
	7	Antisana Ecological Reserve	Tambo	312,90	625,80	75,36	171,83	0,95	46223,00	43683,70	12228	11556,53
	8	El Angel Ecological Reserve	Ibarra	421,70	843,40	101,57	231,58	1,27	7998,00	10186,87	2116	2694,94
	9	Cayambe Coca National Park	Papallacta	230,80	461,60	55,59	126,74	0,70	33415,00	23293,41	8840	6162,28
	10	Cotacachi Cayapas Ecological Reserve	Cotacachi	264,40	528,80	63,68	145,20	0,80	203463,00	162481,01	53826	42984,40
	11	Los Ilinizas Ecological Reserve	Latacunga	118,90	237,80	28,64	65,29	0,36	97675,00	35076,88	25840	9279,60
	12	Pululahua Geobotanical Reserve	Quito	184,00	368,00	44,32	101,04	0,56	158024,00	87820,64	41805	23232,97
	13	Chimborazo Fauna Production Reserve	Riobamba	58,00	116,00	13,97	31,85	0,18	127863,00	22399,00	33826	5925,66
	14	Pasochoa Wildlife Refuge	Quito	132,70	265,40	31,96	72,87	0,40	20465,00	8202,35	5414	2169,93
	15	Bowling National Recreation Area	Latacunga	94,00	188,00	22,64	51,62	0,28	47874,00	13592,00	12665	3595,77
	16	Yacuri National Park	Amaluza	791,40	1582,80	190,61	434,60	2,39	2302,00	5502,46	609	1455,68
	17	Quimsacocha National Recreation Area	Basin	385,30	770,60	92,80	211,59	1,16	0,00	-	-	-
Amazon	18	Siete Iglesias Municipal Ecological Area of Conservation	Macas	384,30	768,60	92,56	211,04	1,16	0,00	-	-	-
	19	Sumaco Napo-Galera National Park	Bathrooms	188,00	376,00	45,28	103,24	0,57	170,00	96,53	45	25,54
	20	Yasuní National Park	Coca	391,50	783,00	94,30	214,99	1,18	11692,00	13825,36	3093	3657,50
	21	Limoncocha Biological Reserve	Coca	488,20	976,40	117,59	268,10	1,47	8051,00	11871,44	2130	3140,59
	22	Ecological Reserve Cofán Bermejo	Quito	401,40	802,80	96,68	220,43	1,21	0,00	0,00	-	-
	23	Cuyabeno Fauna Production Reserve	Lago Agrio	504,20	1008,40	121,44	276,88	1,52	15833,00	24111,36	4189	6378,67
	24	El Condor Biological Reserve	Bathrooms	223,00	446,00	53,71	122,46	0,67	0,00	-	-	-
	25	El Zarza Wildlife Refuge	Bathrooms	544,30	1088,60	131,10	298,90	1,64	0,00	-	-	-
	26	El Quimi Biological Reserve	Bathrooms	223,00	446,00	53,71	122,46	0,67	57,00	38,39		10,16
	27	Cerro Plateado Biological Reserve	Bathrooms	544,30	1088,60	131,10	298,90	1,64	0,00	0,00	-	-
Litoral	28	Machalilla National Park	Pallatanga	361,90	723,80	87,17	198,74	1,09	186363,00	203706,09	49302	53890,50
	29	Arenillas Ecological Reserve	Pallatanga	406,90	813,80	98,00	223,45	1,23	1209,00	1485,83	320	393,08
	30	Manglares Cayapas Mataje Ecological Reserve	Quito	475,80	951,60	114,60	261,29	1,44	0,00	-	-	-
	31	Mache Chimdul Ecological Reserve	Quinindé	293,80	587,60	70,76	161,34	0,89	4516,00	4007,39	1195	1060,16
	32	Manglares Churute Ecological Reserve	Pallatanga	326,30	652,60	78,59	179,19	0,99	1576,00	1553,21	417	410,90
	33	Manglares el Salado Wildlife Production Reserve	Pallatanga	297,80	595,60	71,73	163,54	0,90	-	-	-	-

34	Muisne River Estuary Mangrove Wildlife Refuge	Quito	441,00	882,00	106,22	242,18	1,33	-	-	-	-
35	Heart and Frigate Islands Wildlife Refuge	Pallatanga	448,20	896,40	107,95	246,13	1,35	3805,00	5150,89	1007	1362,67
36	Santa Clara Island Marine Reserve	Machala	399,60	799,20	96,25	219,44	1,21	-	-	-	-
37	La Chiquita Wildlife Refuge	Quito	243,80	487,60	58,72	133,88	0,74	-	-	-	-
38	National Recreation Area Lake Park	Pallatanga	306,30	612,60	73,77	168,21	0,93	-	-	-	-
39	Manglares el Morro Wildlife Refuge	Pallatanga	393,30	786,60	94,73	215,98	1,19	15996,00	19001,64	4232	5026,89
40	Esmeraldas River Estuary Mangrove Wildlife Refuge	Quito	387,80	775,60	93,40	212,96	1,17	-	-	-	-
41	Puntilla de Santa Elena Coastal Marine Wildlife Production Reserve	Pallatanga	416,70	833,40	100,36	228,83	1,26	324288,00	408140,89	85790	107973,78
42	Marina Galera San Francisco Reserve	Quito	472,70	945,40	113,85	259,58	1,43	1016,00	1450,56	269	383,75
43	Santay Island National Recreation Area	Pallatanga	280,20	560,40	67,49	153,87	0,85	278340,00	235558,88	73635	62317,16
44	El Pambilar Wildlife Refuge	Quito	356,80	713,60	783,48	1786,34	9,82	-	-	-	-
45	Los Samanes National Recreation Area	Guayaquil	284,20	568,40	68,45	156,07	0,86	-	-	-	-
46	Playas de Villamil Recreation Area	Quito	370,50	741,00	89,24	203,46	1,12	-	-	-	-
47	El Pelado Marine Reserve	Quito	477,80	955,60	115,08	262,39	1,44	-	-	-	-
							56,25	**1'893.627,00**	**$ 1'494.579,38**	**500.959,52**	**$ 395.391,37**

Source: Compiled by author's

3 RESULTS

With the information obtained from the travel distances from the city of Ambato to each of the protected areas, it was possible to identify the variables involved in the monetary calculation of the environmental deterioration due to travel to the Protected Areas (PA) of Ecuador. The distance (D), liters of fuel consumed during the trip (LC), carbon footprint (HCO2), and carbon cost from carbon pricing (CHCO2), are items involved in obtaining the monetary value of carbon dioxide emitted to the PAs.

The Andean region's HCO2 contamination cost represents a value of $149,360.04 with 2017 visits of 275,321 per household group. The Amazon region's HCO2 cost represents a pollution cost of $13,212.45 with 9472 visitors per household group.

Finally, emissions generated by vehicular activity in the littoral region represent an economic value of $232,818.88 representing 58.88% of the total CO2 cost with visitors per household group of 216,166 in 2017.

On the other hand, the cost of HCO2 contamination per visitor has been calculated, in the hypothetical case that the trip is made individually, obtaining as a result in the Andean region a value of $564,580.93 with a total number of visits of 1'040,715 in 2017. The HCO2 cost of the Amazon region represents a pollution cost of $49,943.08 with 35,803 visitors. Finally, the emissions generated by vehicular activity by the 817,109 visitors in the littoral region in 2017 represent an economic value of $232,818.88.

The number of visitors per family group is a determining factor in calculating environmental degradation, due to the direct relationship between the number of visits to protected ecological reserves and the distance traveled to the site. Taking as an example the most visited PA, Puntilla de Santa Elena, with 85,790 visitors and 833.40 km round trip, generates a deterioration value of 62,317.16 USD of CO2, considering that this place is located in the Littoral Region.

4 DISCUSSIONS

As the world population increases Nature suffers a deterioration due to the accelerated exploitation of livestock, fishing, industry, and urbanization. These factors are increasingly displacing Natural by human creation (Tommasino & Foladori, 2001). By keeping Nature protected we preserve sustainable development as described by Gómez-Castro, Samón-Veloso,

& Brull-González, 2018, whose environmental value in monetary terms would be worth much more than its resource exploitation. (Navarro Gómez, 2016). However, calculating the carbon footprint of travel to protected areas shows us that just because humans are on the planet, Nature suffers environmental wear and tear.

This effect of human beings on the environment by using traditional means of transport whose pollution is inevitable signals us to change the way to generate sustainable visits through means that science must necessarily create and thus achieves a balance between social, economic, and environmental dimensions as described by Calvo, Molina and Salvachúa 2016.

5 CONCLUSION

According to the information generated after the application of the method of economic valuation of carbon dioxide (CO2) emissions generated from the combustion of gasoline used by vehicles, we observe that each trip made to the different Protected Areas of the country causes the dispersion of this element in the air, a component qualified as one of the greenhouse gases that contributes to the deterioration of the ozone layer and climate change. However, the use of this mechanism is essential for the mobility of people, because today owning a vehicle has become a necessity that people seek to satisfy in one way or another. Thus, CO2 emissions are inevitable in that situation, questioning the need for mobility and vehicle use by proposing sustainable mobility strategies for the benefit of society and the environment.

The Protected Areas have the objective of defending Nature wealth of the national ecosystems, which contribute to the mitigation of pollution and deterioration of the environment, due to their natural and cultural attributes and the environmental services they provide to society, becoming the main conservation strategy and source of economic, social and environmental development. Tourism is one of the main activities carried out within this context, increasing the number of visitors to the Protected Areas and therefore the mobilization of people using a vehicle.

With the application of the proposed model, we can visualize, in economic terms, the damage caused to the environment, and propose the economic recognition of the environmental deterioration caused by the displacement of visitors to the PA. Then, through the National Environmental Accounting System these values are recognized with the purpose of improving public policies, laws, and regulations that control the use of natural resources and mitigate the elements that affect the environment, looking for an alternative that includes positive aspects jointly in the social, environmental, and economic areas.

The total environmental cost of deterioration corresponds to 395,391.37 USD, of which 58.88% corresponds to the Littoral region, 37.78% to the Inter-Andean region and 3.34% represent the Amazon region with the lowest cost of HCO2 pollution. From the above we can deduce that the Protected Areas located in the littoral and Andean regions are the most visited during 2017, under the context of visitor preferences and travel distance, so we can also know that the PAs of the Inter-Andean region is the most visited by national visitors due to the short travel time by the relationship between the city of Ambato as the center of the country and each Protected Area.

REFERENCES

Aguado, I., Echeverria, C., & Barrutia, J. (2009). El desarrollo sostenible a lo largo de la historia del pensamiento económico. *Revista de economía mundial*, *21*(2009), 87-110.

Alaña, P., Capa, L., & Sotomayor, J. (2017). Desarrollo sostenible y evolución de la legislación ambiental en las Mipymes del ecuador. *Revista Universidad y Sociedad*, *9*(1), 91-99.

Alcántara, V. (2003). *Sistema económico y sistema ecológico.* Barcelona: Universidad Autónoma de Barcelona.65pp. https://www.idescat.cat/serveis/biblioteca/docs/bib/docest/cs-mediambient.pdf

Banco Mundial. (21 de Abril de 2016). *Panel de Fijación del Precio del Carbono: Definición de una visión transformadora para 2020 y años venideros*. Obtenido de http://www.bancomundial.org/es/news/speech/2016/04/21/carbon-pricing-panel---setting-a-transformational-vision-for-2020-and-beyond

Borrini, G., Dubley , N., Jaeger , T., Lassen , B., Pathak, N., Philips , A., & Sandwith, T. (2014). *Gobernanza de Áreas Protegidas. De la comprensión a la acción.* Suiza: Unión Internacional para la Conservación de la Naturaleza y de los Recursos Naturales.

Calvo, D., Molina, M. T., & Salvachúa, J. (2016). *Ciencias de la Tierra y del Medioambiente*. Madrid, España: Mc Graw Hill.

Cantú Martinez, P. C. (2002). El Deterioro Ambiental y el futuro de la humanidad. *Ingenierías*, *5*(14), 30-35. http://eprints.uanl.mx/10078/1/14Pedro%20Cantu.pdf

Casas Jericó, M., & Puig Ibaguer, J. (2017). El impacto ambiental: un despertar ético valioso para la educación. *Teor. educ.*, *20*(1-2017), 101-128.

Cifuentes Sandoval, G. E. (2008). El Medio Ambiente. Un concepto jurídico indeterminado en Colombia. *Justicia Juris*, *9* (Abril-Septiembre 2008), 37-49. http://hdl.handle.net/11619/1051

Contreras, A. L. (2016). *La Contabilidad Ambiental Nacional, contribución al Desarrollo Sostenible en Colombia*. Colombia: Universidad Pedagógica y Tecnológica de Colombia UPTC.

D'Amico, M. P. (2015). Debates sobre conservación y áreas naturales protegidas: paradigmas consolidados y nuevos horizontes. *Letras Verdes. Revista Latinoamericana De Estudios Socioambientales, 18*(septiembre 2015), 208-226.

Delacámara, G. (2008). *Análisis económico de externalidades ambientales.* Santiago de Chile: CEPAL.

Dirección Nacional de Biodiversidad, Centro de Información Ambiental CIAM . (2004). Ecuador: Ministerio del Ambiente .

Ekolankidetza. (2012). *Guía práctica para la transformación ecológica de la cooperación al desarrollo Bakeaz.* Agencia Vasca de Cooperación para el Desarrollo, 2012. Obtenido de http://centroderecursos.alboan.org/ebooks/0000/0844/8_BAK_GUI.pdf

Erdenekhuu, N., Kocsi, B., & Máté, D. (2022). A Risk-Based Analysis Approach to Sustainable Construction. *I*(2).

Estenssoro, F. (2010). Crisis ambiental y cambio climático en la política global: Un tema creciente complejo para América Latina. *Revista Universum*, 25(2), 57-77. http://dx.doi.org/10.4067/S0718-23762010000200005

Fernández, L., & Gutiérrez, M. (2013). Bienestar Social, Económico y Ambiental para las Presentes y Futuras Generaciones. *Información tecnológica*, *24*(2), 121-130.

Fernandez, S., Mosquera, J., & Mosquera, J. (2010). Análisis de emisiones de CO2 para diferentes combustibles en la población de ta. *Scientia et Technica*, 141-146.

Frenkel, C., & Rodas, F. (2017). *Río Negro-Sopladora: El descubrimiento de un tesoro natural*. Cuenca-Ecuador: Naturaleza & Cultura Internacional.

Funseam. (2014). *La experiencia del comercio de derechos de emisión como herramienta para mitigar las emisiones de gases de efecto invernadero.* Barcelona: Funseam.

Gómez-Castro, L., Samón-Veloso, L., & Brull-González, M. (2018). propuesta de comunicación ambiental comunitaria para la conservación de la reserva ecológica baitiquirí, guantánamo, CUBA. *Ciencia en su PC, 1*(3), 17-32.

Grupo Banco Mundial. (30 de mayo de 2020). *Situación y tendencias de la fijación del precio al carbono 2020*. Washington. Obtenido de https://openknowledge.worldbank.org/handle/10986/33809

INEC. (2010). *Instituto Nacional de Estadísticas y Censos*. Obtenido de Unidad de Procesamiento: http://www.ecuadorencifras.gob.ec/wp-content/plugins/download-monitor/download.php?id=337&force=0

Landa, R., Carabias, J., & Meave, J. (1997). Deterioro Ambiental una propuesta conceptual para zonas rurales de México. *Economía, Sociedad y Territorio, I*(2), 203-224.

Lorente Saiz, A. (2010). *Ganadería y cambio climático: Una influencia recíproca*. GeoGraphos. *Revista Digital para Estudiantes de Geografía y Ciencias Sociales*, *1*(3), 1-22. http://dx.doi.org/10.14198/GEOGRA2010.1.03

Méndez, J., & Palacios, J. (2017). Determinación del consumo de combustible de vehículos en base a los ciclos de conducción EPA FTP75 y EPA HWFET, en dinamómetro de chasis. *Universidad del Azuay*, *6*. Obtenido de http://dspace.uazuay.edu.ec/handle/datos/7367

Ministerio del Ambiente. (2012). *Estrategia Nacional de Cambio Climático del Ecuador*. Quito-Ecuador: Ministerio del Ambiente (MAE).

Ministerio del ambiente. (2017). *Punto Verde*. Obtenido de http://areasprotegidas.ambiente.gob.ec/en/reporte-de-visitas#

Ministerio del Ambiente Ecuador. (2016). *Proyecto de Sostenibilidad Financiera para el Sistema Nacional de Áreas Protegidas. Una visión a su historia.* Quito - Ecuador: Ministerio del Ambiente.

Ministerio del Ambiente MAE. (2013). *Actualización del Estudio de Necesidades y el Análisis de la Brecha de Financiamiento del Sistema Nacional de Áreas Protegidas.* Quito-Ecuador: Manthra Comunicación Integral y Producción editorial.

Navarro Gómez, A. R. (2016). *La Importancia Social del Medio Ambiente y de la Biodiversidad.* Burgos: Asociación de Fundaciones para la Conservación de la Naturaleza y Fundación Biodiversidad-Ministerio de Agricultura, Alimentación y Medio Ambiente. Obtenido de http://afundacionesnaturaleza.org/wp-content/uploads/2016/08/3%C2%BA-Informe_Tercer_Sector_Ambiental_julio_2016_def.pdf

PNUMA. (15 de Diciembre de 2012). *Seguimiento a nuestro medio ambiente en transformación: de Río a Río+20 (1992-2012).* Programa de Nacionaes Unidas para el Medio Ambiente. Nairobi: Division de Evaluación y Alerta Temprana del PNUMA.

Rojas, Y. (2014). La historia de las áreas protegidas en Colombia, sus firmas de gobierno y las alternativas para la gobernanza. *Sociedad y Economía*, *27*(2014), 155-176.

Severiche-Sierra, C., Gómez-Bustamante, E., & Jaimes-Morales, J. (2016). La educación ambiental como base cultural y estrategia para el desarrollo sostenible. *TELOS. Revista de Estudios Interdisciplinarios en Ciencias Sociales*, *18*(2), 266–281. https://www.redalyc.org/articulo.oa?id=99345727007

SNAP. (2017). *Mapa Sistema Nacional de Áreas Protegidas*. Obtenido de http://areasprotegidas.ambiente.gob.ec/mapa-ficha?t=P&id=38

Song, X., Tian, Z., Ding, C., Liu, C., Wang, W., Zhao, R., & Xing, Y. (2022). Digital Economy, Environmental Regulation, and Ecological. *I*(2).

Tommasino, H., & Foladori, G. (2001). La crisis ambiental contemporánea. *Ambiente & Sociedade, 8*, 49-68.

World Bank Group & Ecofys. (2017). *Caron Pricing Watch 2017. An advance brief from the "State and trends of carbon pricing 2017" report, to be released late 2017*. Washington DC 20433: International Bank for Reconstruction and Development.

Zurita, A., Baddi, M., Guillen, A., Lugo Serato, O., & Aguilar Garnica, J. (2015). *Factores causantes de la degradación ambiental.* México: UANL, San Nicolás de los Garza.